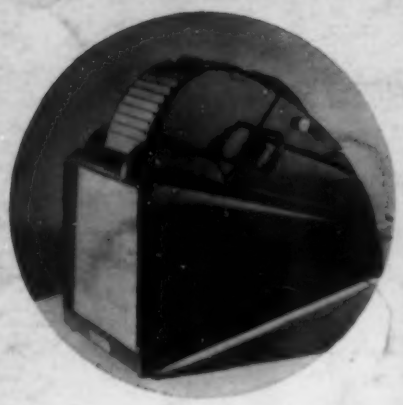
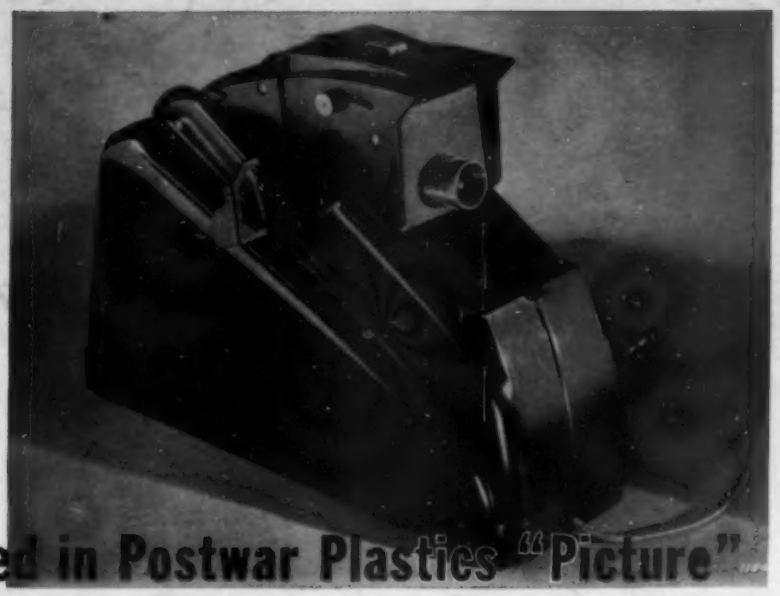
MODERN PLASTICS

DECEMBER 1945





Phenolics featured in Postwar Plastics "Picture"

The phenolics are the most versatile of all plastics. Naturally, this makes their use practically universal throughout industry. In the electrical manufacturing field, for example, you will find phenolic molding compounds being used for literally thousands upon thousands of vital parts. The Novex Combination Projector Viewer shown above serves as an excellent illustration of this point. Its sturdy heat-resistant plastic housing was molded from a Durez phenolic compound

This Novex Combination Projector Viewer effectively demonstrates the practical, sales-stimulating use to which Durez phenolic molding compounds can be put. Its durable, eye-appealing 14"-long body is molded in one piece. The complete unit embodies several molded Durez parts. With molded-in inserts, these, naturally, help to make assembly a simple process and keep production costs at a minimum.

Heat-Resistant Housing

By molding the housing for this Combination Projector Viewer of Durez, the manufacturers gain the heat-resisting and heat-insulating characteristics so necessary for the efficient operation of a machine of this type. Furthermore, a rugged yet lightweight construction results.

Properties of the Phenolics

Just as the Novex Corporation found a Durez phenolic plastic that fitted their job, so have many other manufacturers. Such desirable properties as heat and moisture resistance and dielectric strength make Durez compounds of unusual value to electrical manufacturers. Additional inherent characteristics such as highest dimensional stability at temperature extremes, excellent moldability, and impact strength make them extremely useful to the automotive industry. Closure manufacturers find the eye-appealing, non-bleeding finish of molded Durez to be the answer to their materials problems. Time and again the versatility of the more than 300 Durez phenolic molding compounds has provided the solution to the materials problems of the imaginative design engineer.

Competent Assistance Available

The Durez laboratory technician is an experienced man. Years of successful development work and the continuing leadership of Durez phenolic plastics attest this. Your custom molder is also an experienced man. Many new molding methods and processes make his service even more valuable than before. Put these two men together and you'll stand an excellent chance of coming up with the answer to any practical plastic materials problem which you may have. The services of the Durez staff are available at all times to you and your custom molder. Durez Plastics & Chemicals, Inc., 2612 Walck Road, North Tonawanda, N. Y.

Export Agents: Omni Products Corporation, 40 East 34th Street, New York 16, N. Y.

DUREZ

PHENOLIC RESINS

- MOLDING COMPOUNDS
- INDUSTRIAL RESINS
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THE GEM OF PLASTICS

In the short space of a quarter century, Radio, born of wireless, has become a vast and vital American influence.

Radio's youth was marked with outstanding developments, constant improvements. Its war years warrant a "well done" from all who can now rejoice over Victory! The new peace era, just begun, heralds for Radio, opportunities far beyond the power of prophecy.

In our supporting role, we, of Catalin, salute the Radio industry — and picture with pride the distinguished and exquisitely colorful housing designed of Catalin for *The New Post-war Emerson Radio.*

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Modern Plastics

AND PLASTICS

★ ★ ★

DECEMBER 1945

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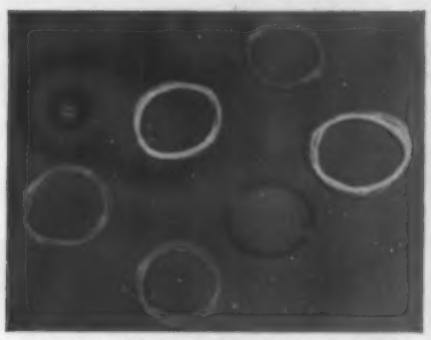
● WIRE INSULATION

● COATED FABRIC

These are typical applications for Geon Latex



● COATED SILK AND NYLON THREAD

Water-borne polyvinyl resins provide safer, simpler processing methods

These finished products indicate the variety of articles that can be made using GEON latex as one of the basic raw materials. For example, thin coatings of GEON latex can be applied to fabric, leather, paper, fibre, thread, wire, or any other material to which coatings can be applied by conventional methods.

Suitably formulated, GEON latex—a water dispersion containing approximately 50% vinyl resin—can be used on standard processing equipment. Being a water system, GEON latex offers many advantages not to be found in solvent systems—simplicity and economy of processing—no danger of toxic vapors, or explosion—elimination of expensive, cumbersome solvent recovery systems. Highly stable, GEON latex is *not* rubber and contains no rubber.

GEON latex is not a "miracle material" that will do away with other coating methods. Yet already there is evidence that it will open entire new fields in the manufacture of coatings, sheet, and film. For more information write Dept. II-12, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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B. F. Goodrich Chemical Company

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Case Histories

from the RICHARDSON files . . .

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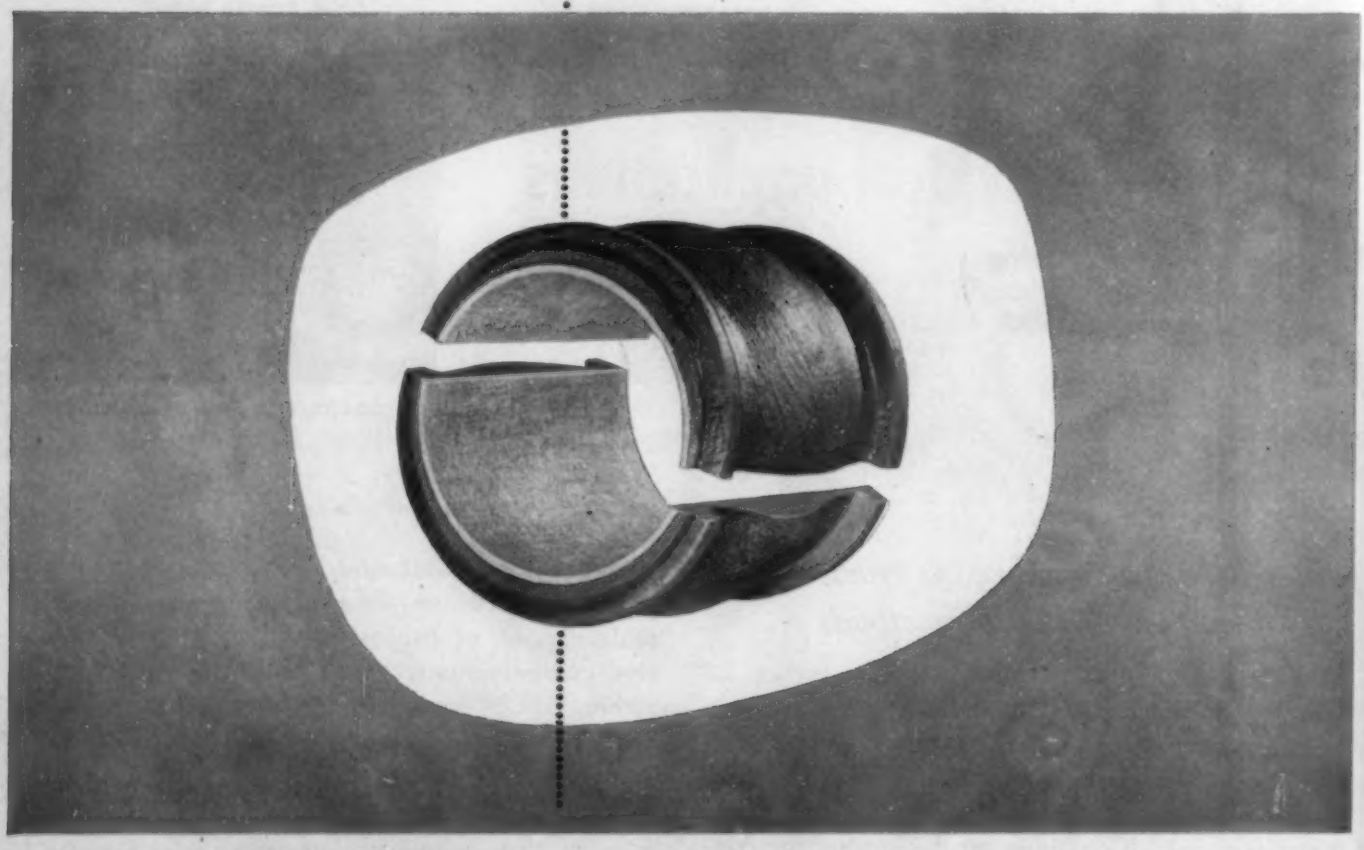
Solution: Richardson Plasticians designed a bearing composed of a wearing surface of graphitized Laminated INSUROK for strength and hardness, and live rubber for shock and noise absorption. It can operate with or without lubrication.

This is typical of the plastics problems handled by Richardson Plasticians almost daily. No two are exactly alike—but each is solved with the same background of experience unique in the plastics industry. For in addition to molding and laminating famous INSUROK Precision Plastics, Richardson has complete facilities for molding bituminous plastics, rubber and rubber-plastics combinations—and, of course, all fabricating and finishing operations.



INSUROK *Precision Plastics*

The RICHARDSON COMPANY

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THE OLD WAY:

Heavy steel top, non-transparent, necessitated frequent lifting to observe and attend baby...disturbed the maintenance of exact humidity and temperature prescribed for each infant.

THE NEW WAY: With smartly designed top of crystal-clear, shatter-resistant "Lucite," infant is always under instant observation. Sliding panels of "Lucite" enable nurse to insert hands without greatly altering humidity and temperature. Lighter weight . . . Greatly improved appearance.

• • •

"Humidicrib" manufactured by Wilmot Castle Co., Rochester, N. Y.,
Panels of "Lucite" fabricated by Jamestown Metal Products Inc., Jamestown, N. Y.

In the modern hospital, the "Humidicrib," by providing scientific control of humidity and temperature, greatly increases the premature infant's chance of survival and of normal, healthy growth. These chances are even greater since the "Humidicrib" is now made with cover and sliding panels of "Lucite" methyl methacrylate resin. For one thing, the "Lucite" cover collects much less condensation than the old-style cover. More important is "Lucite's" transparency...the nurse has the infant under complete observation, with no need to raise the cover. "Lucite" is shatter-resistant . . . The vastly improved appearance of the "Lucite" cover is obvious.

Available again, "Lucite" is ready to serve your peacetime product needs. Address E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, N. J.

FOR PLASTICS . . CONSULT DU PONT

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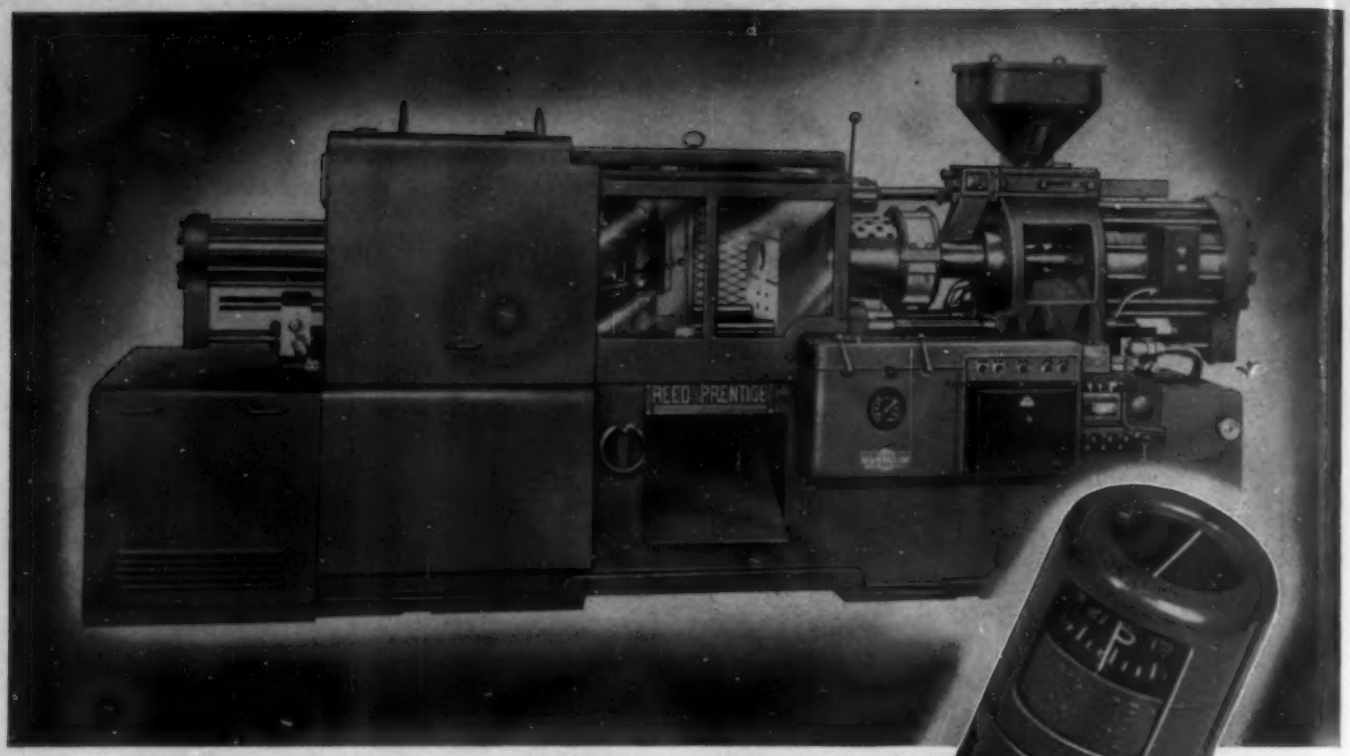

Combination compass and match case molded by DuPage Plastics Co., Chicago, Ill.

CHART A SOUND COURSE FOR... *Reconversion*

Reed-Prentice Injection Machines used to mold this plastic compass from cellulose acetate butyrate, as standard equipment for B-29 crews and fighter pilots — are now ready to mold this useful article, and a thousand other practical plastic products for civilians.

Weighing less than 2 ounces, measuring 3 inches high by 1 inch dia., the compass clearly demonstrated the molder's ability to produce precision parts to meet rigid Government inspection on Reed-Prentice machines under war-time pressure. The same machines now provide the necessary equipment to quickly chart a sound course for reconversion!

The largest builders of plastic injection molding machines in the World, offer 22, 16, 12, 8, 6 and 4 Oz. models — a complete line to meet all practical molding problems.

Recent refinements, of the 10D-8 and 6 Oz. model (shown above), include:

1. One piece steel welded base.
2. Hydraulic piping and valves mounted outside base for accessibility.
3. New guards, improving appearance, easily removed for hydraulic maintenance.
4. Electric timing clocks mounted in dust proof boxes.
5. Quick adjustment of clamping and injection units by rack and pinion.
6. Transparent plastic window for safety door.

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DO YOU HAVE A *"Borderline"* PLASTICS PROBLEM?

Look into

LUMARITH* XF

FORM RETENTIVE,
FLAME RESISTANT
high acetyl cellulose acetate

THERMOPLASTIC?

THERMOSETTING?

Fluorescent lighting fixture part, molded by Bryant Electric Co.

Here is news of importance to manufacturers and designers who want to retain these thermoplastic advantages for their product: high-speed moldability . . . toughness without fillers . . . surface permanence . . . economical production.

LUMARITH XF SERIES OF THERMOPLASTIC MOLDING MATERIALS, a new Celanese development, is providing the answer to many "borderline" plastics molding problems. These formulations are rated self-extinguishing when tested according to ASTM method D 635-41T, and show excellent form retention when subjected to heat and humidity. Giving high values for flexural and tensile strength, they offer ⅓ *greater resistance to cold flow* than standard formulations of cellulose acetate.

In the short time since its introduction, Lumarith XF has broadened the field of usefulness of the cellulosics tremendously—particularly in the electrical and allied fields where flame resistance and stability under load and heat are of prime importance.

If you are planning a product that you feel could be improved or more economically produced by thermoplastics, get in touch with the Celanese technical service staff for complete data on this new Lumarith plastic. Celanese Plastics Corporation, *a division of Celanese Corporation of America*, 180 Madison Avenue, New York 16, N. Y.

A Celanese Plastic*

*Reg. U. S. Pat. Off.

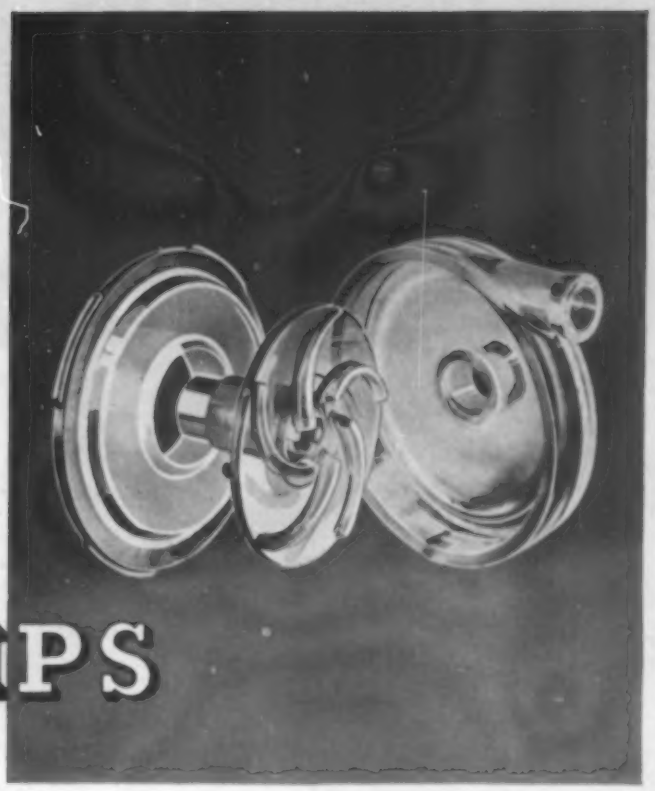
WARNING!
PROFITS AHEAD!

Warning . . . because that big change may not come from the plastics you've imagined. But, with expert, experienced advice, they may roll in from an un-envisioned plastics source! We know the signals of profit and loss in every plastic–every molding process. Let's talk about your plastic plans.

HAVE YOU A PLASTICS PROBLEM?

PROLON PLASTICS

FROM CHRISTMAS TREE ORNAMENTS TO GLASS PUMPS



WHEN war cut off America's supply of imported Christmas tree ornaments, Corning stepped into the picture . . . adapted its production facilities to turn them out at the rate of hundreds per minute. And they were better, more rugged, more brilliant.

When chemical plants handling highly corrosive materials complained that their metal pumps were being eaten away almost as fast as they were installed, Corning was consulted. In cooperation with the Nash Engineering Company, a pump was developed in which the material being handled came in contact only with corrosion resistant PYREX brand Glass. Today these pumps are in constant day-in and day-out service.

These are extreme examples of the glass engineering problems Corning has helped to solve. Whether the problem involves beautiful decorations to be produced by the million with a sales and price appeal for the general public, or whether industrial parts of chemical resistant glass designed for serviceability and made to precision tolerances, to answer the rigid requirements of an engineer—Corning will be glad to work with you on the solution of your problem. Corning engineering service is available for the asking.

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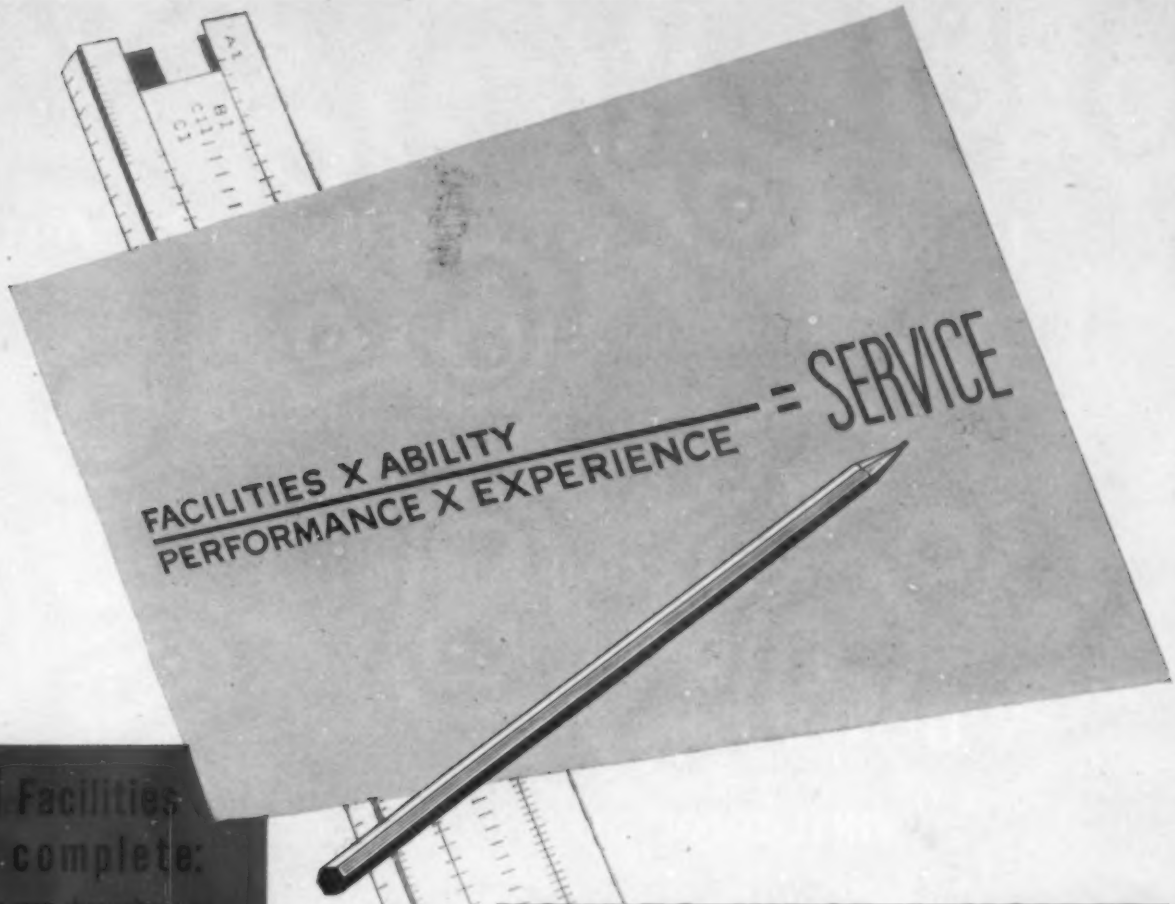

HOW TO JUDGE A MOLDER:

What are you buying when you engage the services of a plastics molder? The obvious answer is production — capable mechanical performance. And that's right. The first basis for judgment *is* quality production. But there are many reputable molding firms qualified to meet this first test. That sometimes makes further judgment difficult.

In Minneapolis Plastic Molders' organization, every job represents an obligation to provide service that goes beyond technical skill. Such service has many elements. Originality, creative engineering ability and appreciation of the buyer's sales problems are examples. This MPM service has grown from broad, practical experience. It is coupled with complete facilities and proved technical ability.

Judgment on the basis of service can be *vital* with the urgent competition ahead. You profit through such advantages as lowered costs and product improvements. MPM is prepared to demonstrate how this service has worked to the advantage of others. Write for information.

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Each has its individual characteristics, and has proved, both in laboratory experimental work and actual practice, to be an ideal material for plastic molds.

Both Disston Plastiron and Plastalloy provide these important advantages:

- A low carbon content
- Thoroughly clean and uniformly sound
- Produce unusually smooth cavities
- Will withstand extreme hobbing
- Carburize evenly
- Ideal for difficult shapes

LET DISSTON EXPERTS AID YOU IN WORKING OUT YOUR POSTWAR PLANS—Disston metallurgists and engineers will gladly cooperate with you in adapting Plastiron or Plastalloy to your present methods, or to your postwar products. Write fully, and in confidence.

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You can depend on this quality whether you use the colorful mass tones or the great variety of pleasing tints derived from them . . . beautiful orchids, corals and pinks from the reds—clean tans, creams, ivories and buffs from the yellows and browns.

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HIGH TINTING STRENGTH NON-BLEEDING
FINE PARTICLE SIZE

COLUMBIAN CARBON COMPANY

ARMY E NAVY

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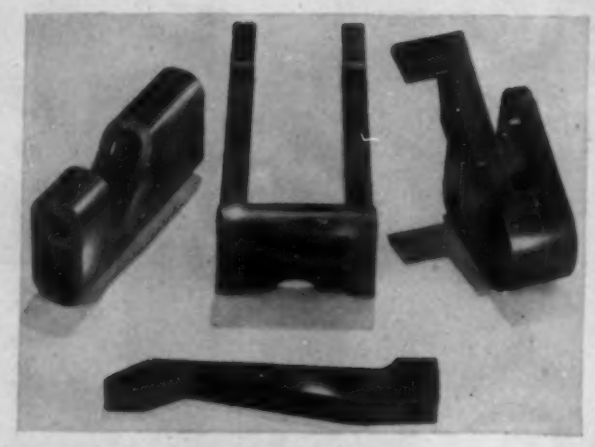
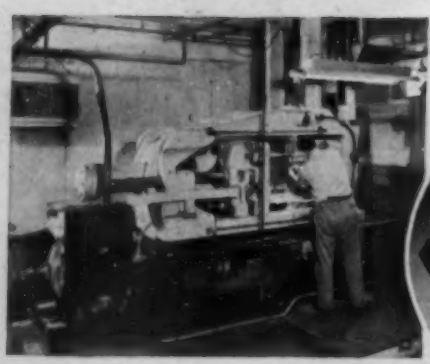
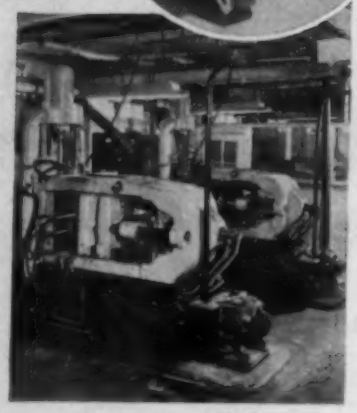
YELLOWS REDS BROWNS BLACK

Injection MOLDING

NUMBER 12
OF A SERIES







USUALLY we have plenty to say on our Injection Molding page, but this month we're going to let the pictures do the talking. The unusual looking moldings shown here may look like big compression moldings, but they're not; they're big *injection* moldings, and the tape line in the top picture indicates just *how* big they are.

They are the simulated parts of a 20-mm. gun breech, used for instruction of Navy gunners, and are made for Noel J. Poux of Tenite II by the Erie Resistor Corporation of Erie, Pa., on a 16-ounce Lester. The largest part is made of two 22-ounce moldings, produced by using an auxiliary feeder and a double shot to fill the big mold cavity.

While not designed in the manner of commercial injection molded parts, these pieces should give you an idea of the increased scope of injection molding as done by Erie Resistor on a Lester. Also shown are two 4-ounce Lesters and the 16-ounce machine, "for the big, heavy, tough molding jobs." Lack of space cuts short our sales talk this time, but if you want to know more, write today for details of the entire Lester line.

Investigate These Improvements

Lesters are now built with (1) a new vertical injection cylinder, with solid plunger and internally-heated torpedo, which plasticizes more material at higher speed without burning; (2) a one-piece, cast steel, box-type frame, exclusive with Lester, which provides up to 600 tons locking pressure and eliminates the wear and weaving which are characteristic of ordinary frames; (3) greater mold opening and exact control of opening, which permits use of larger molds and speeds cycling; (4) larger diameter die height adjusting screw, eliminating possibility of mold deflection (adjustment by single hand crank); (5) automatic hydraulic ejection, standard on large machines; (6) flow control system permits separate control of injection speed and pressure; (7) new Lester safety gate is interlocked hydraulically, electrically and mechanically.

INJECTION MOLDING MACHINES

"Shaping the Things of Tomorrow"

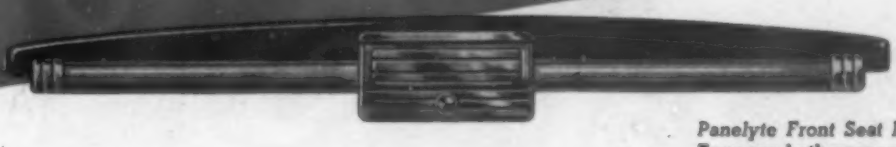
National Distributors:

LESTER-PHOENIX, INC., 2711 Church Ave., Cleveland 13, Ohio

The ALL PLASTIC car is the bunk!

But ...Here are four spots where PANELYTE laminated plastic is practical!

An Instrument Panel of Panelyte is non-rattling and warm to the touch.



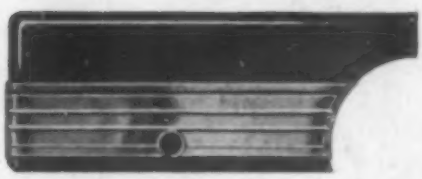
Panelyte Front Seat Back Tops are both economical and stylish.

PARTS molded of Panelyte plastic have five realistic advantages: (1) weight saving; (2) freedom from corrosion; (3) ease of finishing; (4) reduction of vibration and "rattling"; (5) pleasant to the touch.

Panelyte engineers are equipped to assist in the design of molded (and fabricated) parts which *logically* can, or should, be made of Panelyte.

Mass production techniques . . . demonstrated before Pearl Harbor . . . improved under urgency of war demands . . . assure deliveries to meet the most exacting schedules.

If you would like samples of Panelyte and our factual "Engineering Data Book," please write . . . or perhaps you would prefer to have a Sales Engineer call on you?



A light, warm-feeling Glove Compartment Door.

A rust proof, sturdy, light weight Deck Lid . . . molded of Panelyte, a worthwhile saving in weight is effected.

PANELYTE *the structural plastic*

PANELYTE DIVISION
ST. REGIS PAPER COMPANY
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● **We are losing no time in reconversion. We are "making time" in filling an order from a clock manufacturer for several hundred thousand plastic clock cases. On another order we are making huge quantities of plastic gear shift knobs. Still another order calls for thousands of handles for cooking utensils. We are in immediate full scale production on civilian products. If you need plastic products or parts we can get going just as quickly on *your* order.**

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Beauty and Utility

IN PLASTICS *and* METALS

Important to all designers is the fact that plastics, metals, and plastic-metal combinations are being produced entirely under one roof by the Bay Manufacturing Division of Auto-Lite. Such examples as this Fifth Avenue Medallion, a finely designed plastic casting mounted on a chrome-plated and decorative bezel . . . the vinylite plastic grommet and nipples (vinylite does not require the heavy walls of rubber products) . . . the etched enamel-filled high polished chrome escutcheon . . . typify fine Auto-Lite craftsmanship.

THE ELECTRIC AUTO-LITE COMPANY

Detroit 2, Mich. — Bay Manufacturing Division — Bay City, Mich.

UNDER ONE BIG ROOF AT . . .

Auto-Lite

Tune in the Auto-Lite Radio Show Starring Dick Haymes
Every Saturday Night, 8:00 P. M. — E. T. on C B S

BUY MORE BONDS

Quiet - Cool -

NEW BALLENTINE SINGLE VALUE CAPACITOR MOTOR

This miniature powerhouse heads the parade of Ballentine Motors now rolling off the production lines and available for prompt delivery.

Like all QUIET Ballentine Motors, the Single Value Capacitor Motor is the result of expert craftsmanship at its best—*precision dynamic balance*—strict adherence to close tolerances. It is especially suitable for built-in applications, as it has no switches—no brushes. Ideal for projectors, fans, and similar applications where high heat losses are not desirable.

Other QUIET Ballentine Motors from 1/1000 to 1/8 H.P. will soon be available.

APPROXIMATE SPECIFICATIONS

Single value capacitor motor. Diameter 3½", Length 3½". Double or single shaft extension. 2 pole—1/20 h.p. 3400 RPM, 4 pole—1/25 h.p. 1700 RPM. Strap type mounting. Cool running, 50% efficiency. Motor parts—rotor and stator available for built-in applications.

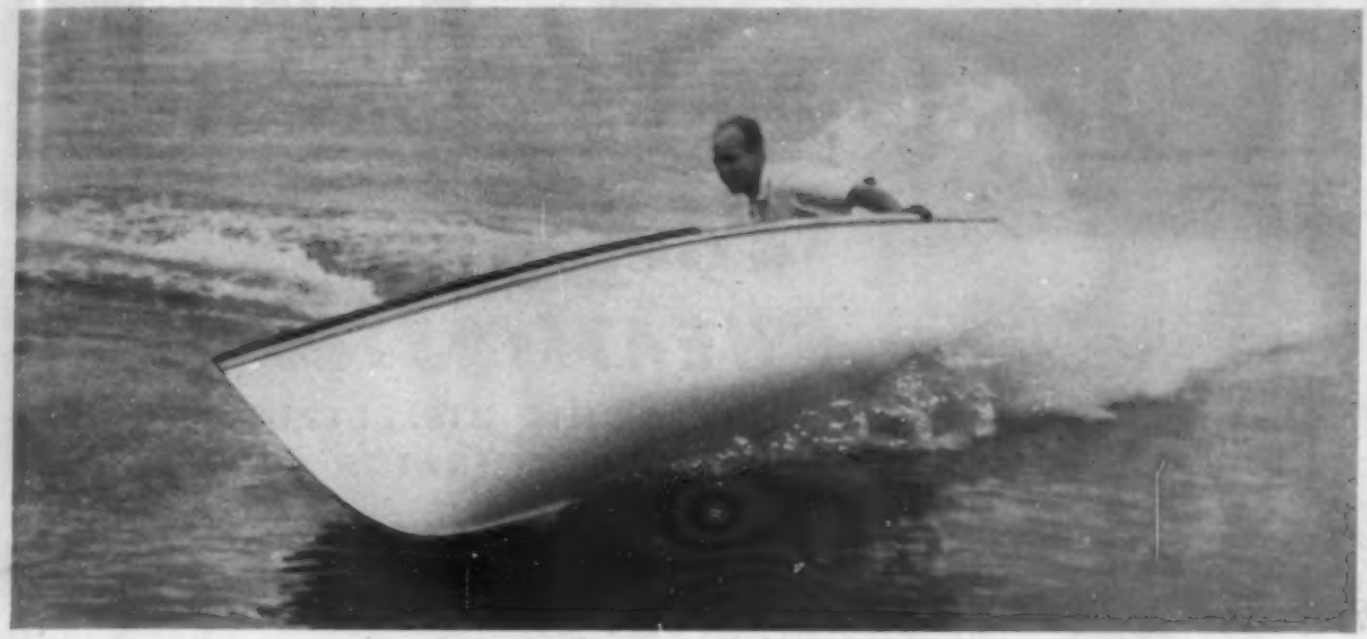
RUSSELL ELECTRIC COMPANY

352 WEST HURON ST., CHICAGO 11, ILLINOIS

Manufacturers of **BALLENTINE MOTORS**

IT'S A WINNER

PLASTI CRAFT



Another WINNER Plastic Product

This new line of plastic boats, as large as fourteen feet, proves conclusively that *size* presents no obstacle to the *Winner Process.* Molded in a single operation, the entire hull is seamless and non-leaking.

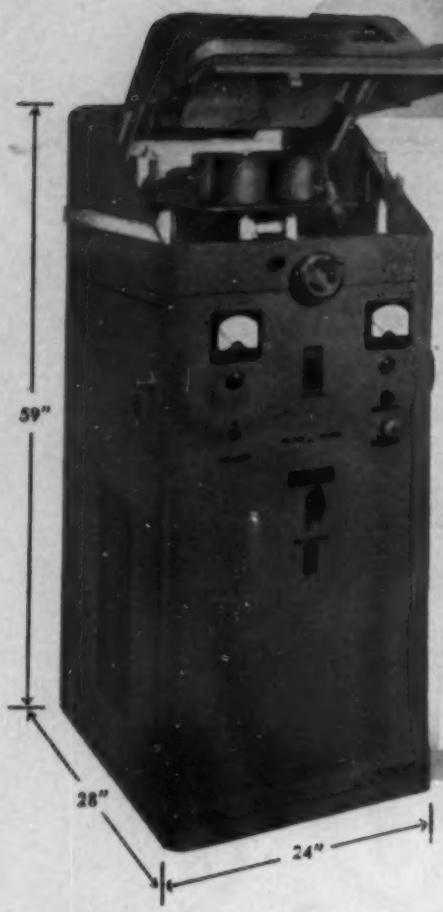
Years of research, experimentation and actual production of marine and aircraft parts designed to withstand severe wartime uses, led to the development of this perfected method of low pressure lamination.

All of the qualities demanded of such products are now available to other fields. Odd shapes and unusual sizes that possess great tensile and impact strength combined with light weight, are possible. Highly resilient and dielectric, *Winner Plastics* also resist vibration, elements and corrosion.

Whether it's to be used under water, in the stratosphere or anywhere "in-between," we feel confident that our engineers can assist you.

WINNER PLASTICS

DIVISION OF WINNER MFG. CO., INC., 200 RAILROAD AVE., WEST TRENTON, N. J.



"Built-in Brains"

THE NEW

Thermatron

"HEATMASTER"

ELECTRONIC DIELECTRIC HEAT GENERATOR

5 KW — 17,000 B.T.U. Per Hour Output

The new "Heatmaster" has its "brains" built in — so that in production it may be operated safely by unskilled help. Operation is truly automatic — being limited to the insertion and removal of preforms on any designated time cycle.

For laboratory work, or manual operation, its advantages are equally outstanding. Owing to its one major control, the technician is enabled to concentrate his attention on the effect of high frequency rather than in the manipulation of electrical controls to produce a desired result.

The inclusion of fluorescent lighting in the electrode cage — while only a detail — illustrates the carefulness of design. The use of new long-life radial fin tubes cuts down operation expense. It has power to heat a 3.3 pound preform in one minute — 5 pounds in 90 seconds.

For plastics or for general purpose use, for research or production, the **THERMATRON** "Heatmaster" with its rugged construction, simplified controls, and generous power represents an outstanding development in electronic dielectric heaters.

All **Thermatron** *ratings based on output*

Send for new circular describing the 5 KW "Heatmaster" and other models in the THERMATRON LINE, ranging from 500 watts to 30 KW in output. Address Desk MP-6

Thermatron Division

RADIO RECEPTOR COMPANY, Inc.

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SINCE 1922 IN RADIO AND ELECTRONICS

Plexiglas STEPS INTO THE HOME OF TOMORROW

Conceived by Rohm & Haas, a three-room PLEXIGLAS "DREAM SUITE" is familiarizing architects, designers, decorators, and home-owners with possible applications of this jewel-like plastic in the home. As the Dream Suite tours department stores and architectural centers, its illuminated plastic walls, enclosures and decorative accessories are being admired by hundreds of thousands . . . . at the John Wanamaker store in Philadelphia alone over 50,000 people saw the exhibit.

Those who mold or fabricate PLEXIGLAS already are benefiting from this interest in the Dream Suite. This spectacular exhibit not only is stimulating the demand for PLEXIGLAS for familiar applications, but also is opening entirely new markets for this war-famed transparent plastic.

We'll be glad to offer technical assistance in adapting PLEXIGLAS to your new product designs. Call or write our nearest office: Philadelphia, Detroit, Los Angeles, Chicago, Cleveland, New York. Canadian Distributor: Hobbs Glass, Ltd., 690 St. James St., Montreal.

A. Framed between sections of edge-lighted PLEXIGLAS walls, a medicine cabinet features PLEXIGLAS shelves and an enclosed, red-lighted "POISON" section.

B. At the dressing table, PLEXIGLAS trays for cosmetics swing out from a pedestal.

C. At left, a cushioned PLEXIGLAS bench. At right, a revolving PLEXIGLAS hatrack and handy rack for shoes.

PLEXIGLAS is a trade-mark, Reg. U. S. Pat. Off.

ONLY ROHM & HAAS MAKES *Plexiglas* CRYSTAL-CLEAR ACRYLIC SHEETS AND MOLDING POWDERS

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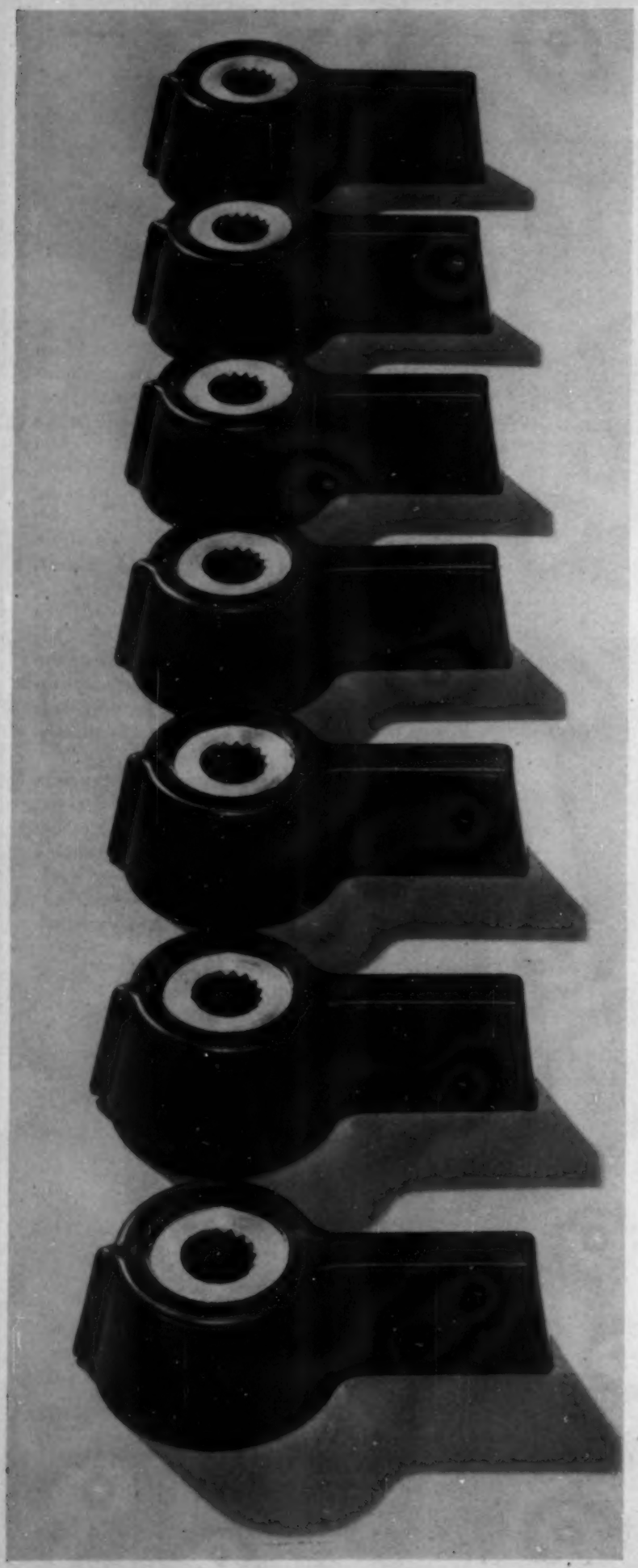

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Delivered *On Time*

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"Give TYBOND the same specifications and they'll give you better looking parts." That's because we put more care in the molding process.

Parts from TYBOND come through uniform—piece after piece—because your order means a lot to all of us. We work together as a team to keep the quality constant.

Faster deliveries—because we have our own mold facilities and can get into production faster. Send prints for quotations, or tell us your problem. There is no obligation.

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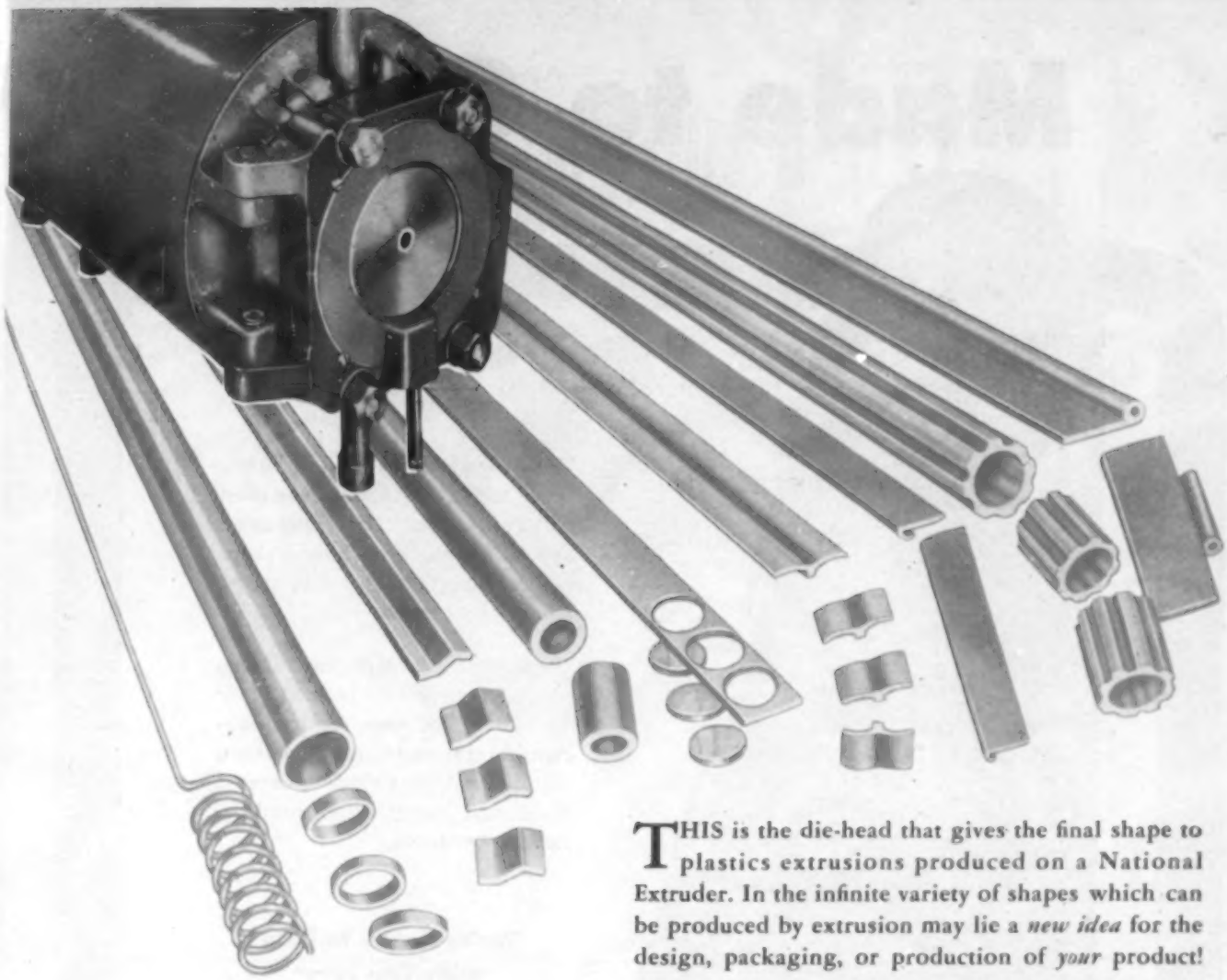

The Head that thinks up NEW IDEAS for YOUR products!

THIS is the die-head that gives the final shape to plastics extrusions produced on a National Extruder. In the infinite variety of shapes which can be produced by extrusion may lie a *new idea* for the design, packaging, or production of *your* product!

Look at the extrusions above. They're typical. And, by stamping, machining, punching, pressing, bending or cutting, you can get another *vast variety* of forms produced economically. Manufacturing costs are often lowered, control of quality improved, engineering for continuous production simplified. Because extrusions have a smooth finish, requiring no additional buffing or polishing, your product has a richer, smarter appearance.

So, do what scores of other successful manufacturers have done. Think of your product in terms of plastics extrusions. Our new catalog, which includes descriptions of America's most complete line of plastics extrusion equipment, and a thorough explanation of the process, will help you apply the extrusion principle to *your* product. Write for it today.

NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION

Made to Order

The new products in your laboratory today may never have been carried in bulk. They may need special pressure or temperature control, special features to guard against contamination.

General American engineers have met such problems before. They have designed cars for the economical transportation of Helium, Sulphuric Acid, Chlorine, Caustic Soda and many other hard-to-handle products.

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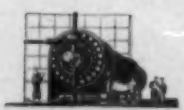

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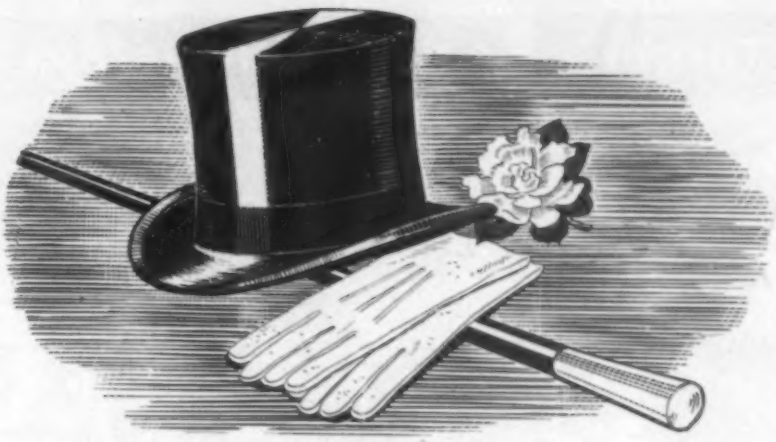

IT isn't because we're high-hat, or because we don't have a high regard for the manufacturer of stock parts and consumer items in plastics.

It's just that we started with a different idea, and we've been kept so busy that we've stuck to it.

You may know exactly what you want, in design, in color, in material. You may have a design which can be modified, with benefit to your product, or for more economical production. You may have little more than a vague idea in the back of your head. We have design engineers, production engineers and laboratory technicians, to advise with you, to create original designs, to give you what you want.

From piece design to final finishing operations and packaging, a highly developed system of quality control has been perfected, and is your assurance of obtaining the finest in custom molded plastics.

Proper die design resulting in faster, more economical molding cycles; experienced molding techniques, physical, chemical and electrical laboratories for research of raw materials and finished products are but a part of our facilities and equipment.

Whether it's injection, extrusion or injection molding of thermo setting plastics, Erie Resistor is qualified to do it "Better", and if Erie Resistor makes it, it will be "Your" product.

BUY VICTORY BONDS

ARMY NAVY E
FOR HIGH ACHIEVEMENT IN WAR PRODUCTION

Plastics Division
ERIE RESISTOR CORP., ERIE, PA.
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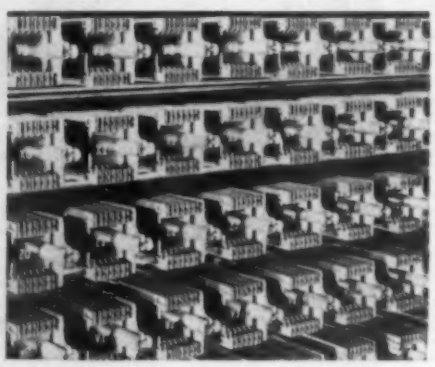
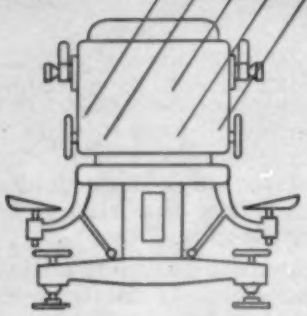
ER
SYMBOL OF QUALITY

Target practice with Relays and Keys





(Left to right) The operator punches the problem data on tape, which is fed into the computer. The solution emerges in the teletype receiver. Relays which figure out the problem look like your dial telephone system.

In designing the gun-control systems which shot down enemy planes, Army ballistic experts were faced by long hours of mathematical calculations.

So Bell Laboratories developed an electrical relay computer. It solved complicated problems more accurately and swiftly than 40 calculators working in shifts around the clock.

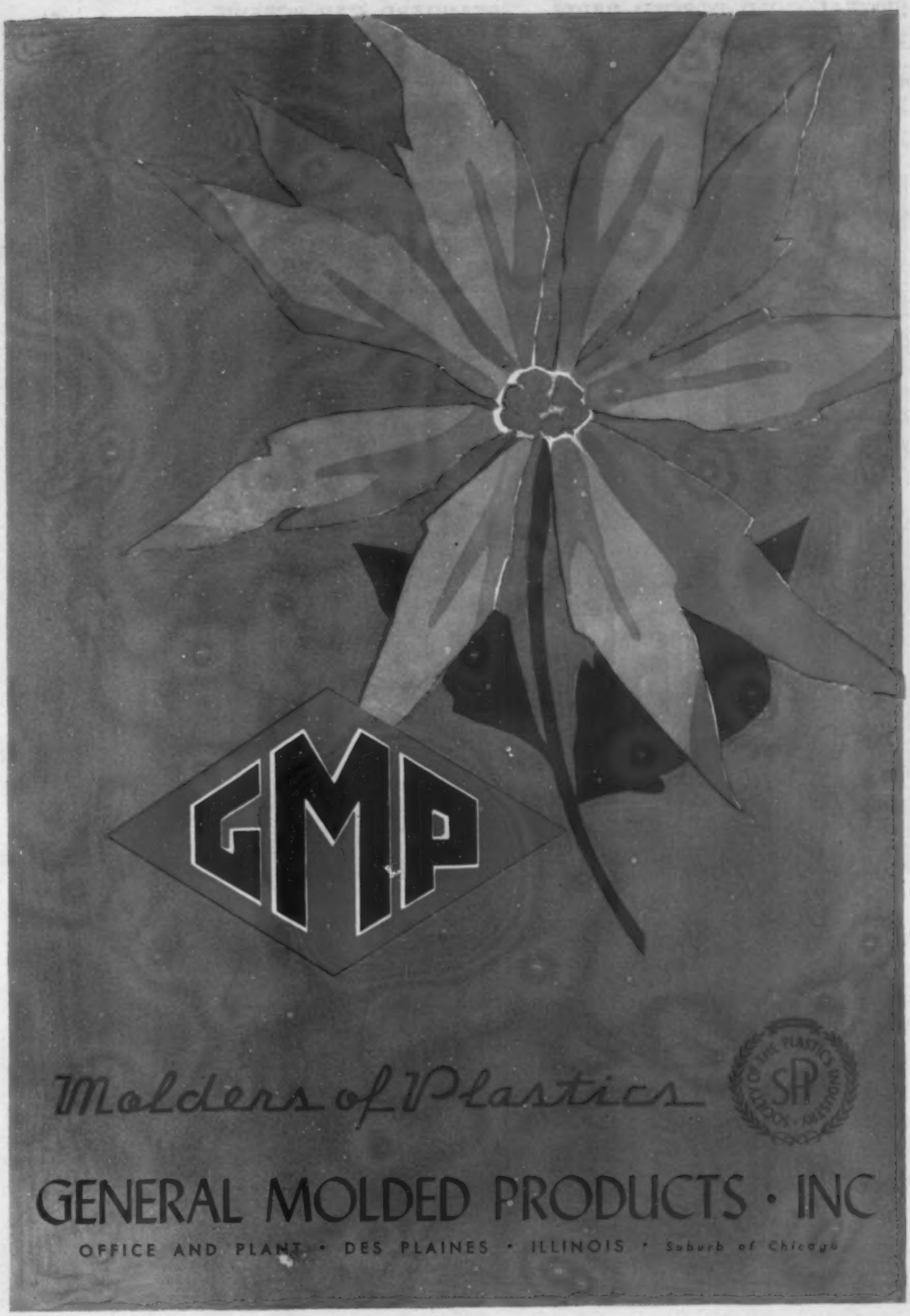
Resembling your dial telephone system, which seeks out and calls a telephone number, this brain-like machine selects and energizes electric circuits to correspond with the numbers fed in. Then it juggles the circuits through scores of combinations corresponding to the successive stages of long calculations. It will even solve triangles and consult mathematical tables. The operator hands it a series of problems with the tips of her fingers — next morning the correct answers are neatly typed. Ballistic experts used this calculator to compute the performance of experimental gun directors and thus to evaluate new designs.

In battle action, Electrical Gun Directors are, of course, instantaneous. Such a director helped to make the port of Antwerp available to our advancing troops by directing the guns which shot down more than 90% of the thousands of buzz bombs.

Every day, your Bell System telephone calls are speeded by calculators which use electric currents to do sums. Even now, lessons learned from the relay computer are being applied to the extension of dialing over toll lines.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE


GMP
Molders of Plastics
SPI
GENERAL MOLDED PRODUCTS · INC
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SPECIAL COLD FORGED PARTS • STANDARD CAP SCREWS • HARDENED AND PRECISION GROUND PARTS • SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES

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Allied is ready to make cold forged parts *fast* . . . and by the million to your exact specifications for trucks, tractors, automobiles, home appliances, rolling stock and other machines. Each forging Allied makes of any type is exactly alike to the finest tolerances. Cold forged in one piece from coiled steel wire or bars, each embodies the strength, precise dimensions and flexibility of design that have made dependable quality synonymous with the Allied name. Find out now just how much the precision workmanship of Allied's four superbly-equipped plants can contribute to your production problems. Send in your blueprints—or consult Allied engineers. They are always at your service.

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Again IRVINGTON leads the way!

with Fibron

EXTRUDED TUBINGS AND TAPE
of low-loss

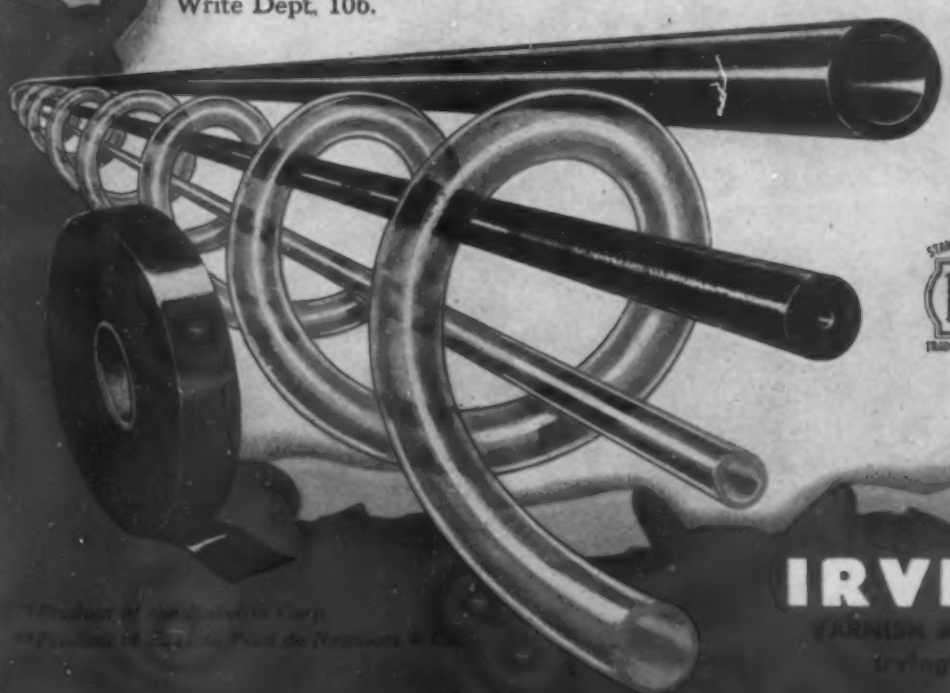
POLYETHYLENE* and POLYTHENE**

Irvington now offers these new thermo-plastic materials, in extruded and calendered tape forms, for use as insulation where high frequencies are involved and applications where exceptional chemical and moisture resistance are required.

For electrical insulation . . . superior low-loss electrical properties, low moisture absorption, and high resistance to ozone, oil, acids and alkalis, make Polyethylene and Polythene ideal for high frequency applications and other special requirements as well.

For chemical applications . . . Both Polyethylene and Polythene are highly resistant to the halogen group including fluorine . . . offer the low density and other properties of paraffin, *plus* superior mechanical strength and higher melting point; can be formed and reformed in service as desired.

Samples, and complete cooperation on your problems, are freely offered. Write Dept. 106.



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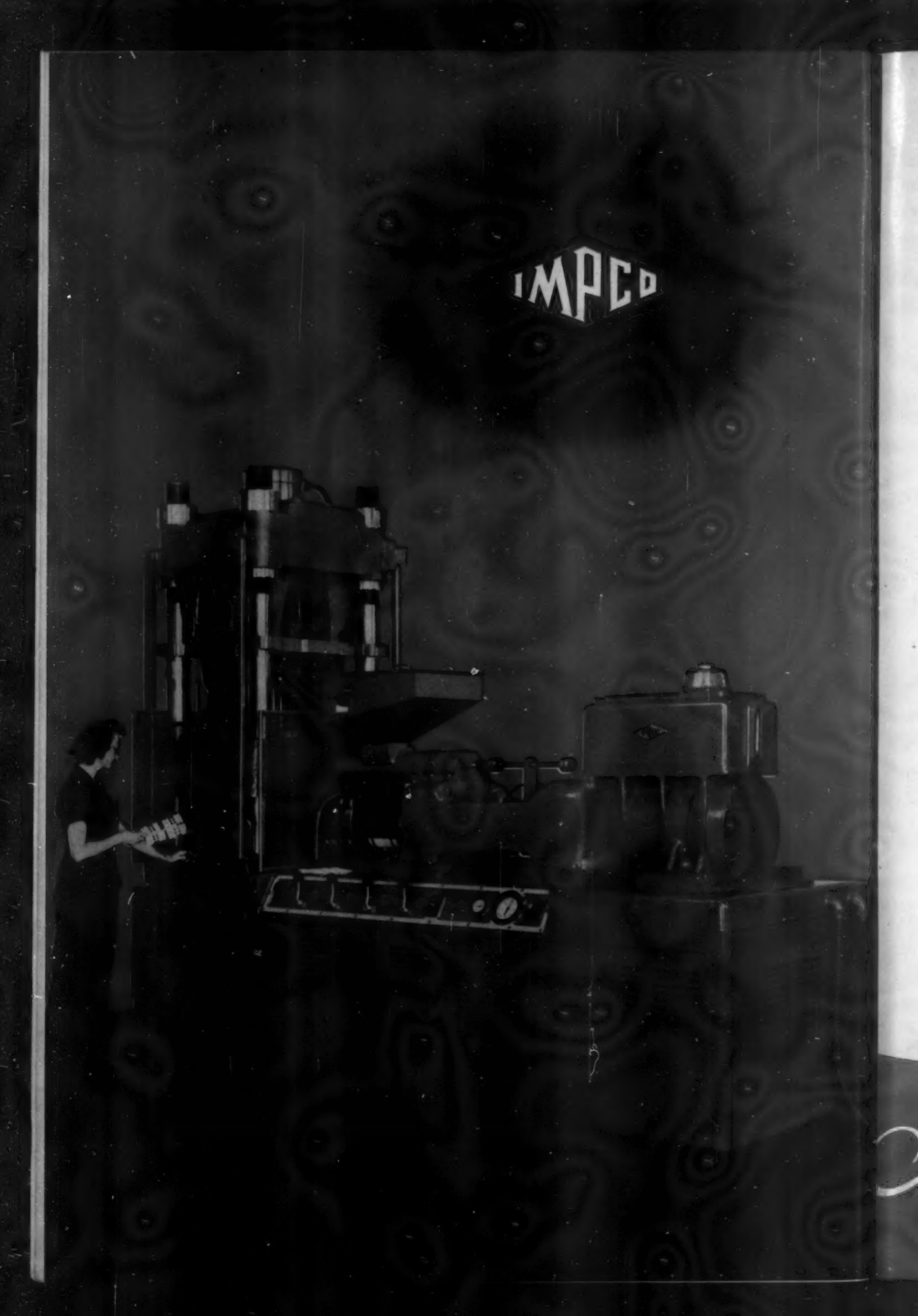
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A *Versatile* Plastic Molding Machine

Embodying the principles of Injection, Compression and Transfer Molding

Operates as a conventional Injection, Compression or Transfer Molding Machine—or in combination.

Permits:

1. Faster, improved techniques for molding large castings of heavy cross-sections.
2. Substantial savings in finishing costs.
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5. Elimination of shrinkage and voids on heavy sections.
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Horizontal Injection Machines of 4 and 8 ounce capacity

Self-contained Transfer Machines up to 500 tons capacity

Injection-Compression Machines
- Model VF-1 Laboratory
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Compression Machines up to 500 tons capacity

Units for Controlling Mold Temperatures—three different sizes

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Improved **PAPER MACHINERY CORPORATION**

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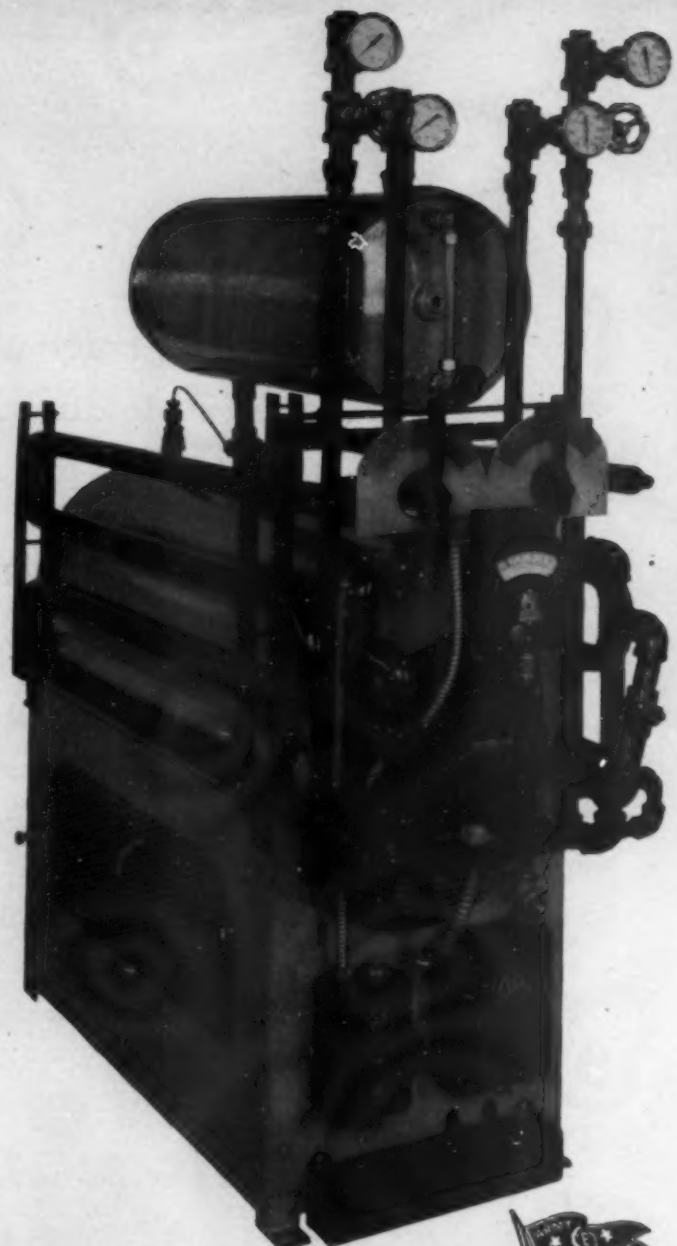
Extruder Temperature Control Unit

- ☆ Wide temperature range available
- ☆ Sustains high or low extruding temperatures
- ☆ Supplies or removes heat from extruder as required
- ☆ Multiple circuits can be accommodated
- ☆ Hand lever selection of pre-determined extruding temperatures
- ☆ Available in two sizes
- ☆ Compact



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NOTICE the attractive design... the rich, eye-appealing beauty of these Norton-molded plastic jewelry boxes. Little wonder they are proving such sales-getters in the highly competitive jewelry business.

The natural beauty of plastics, combined with the economy which their use effects, makes them extremely valuable to the manufacturer whose merchandising policy demands an unusually attractive package.

* * *

The two decades of successful product development work which make up the background of Norton's design engineers, equip them to advise you expertly on practically any plastics molding question which you may have. Combine this wealth of experience with Norton's large facilities for injection and compression molding, and you can readily understand why so many of America's greatest companies have their custom molding done here. Bring your plastics molding problems to a company with a proved record throughout industry for "knowing their business". Norton Laboratories, Inc., Lockport, N. Y. *Sales Offices: 347 Fifth Ave., New York; 9 South Clinton St., Chicago.*

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KAYPAR fuel pump protector

KAYGREY radio dust cover

KAYGREY magneto insulator

KAYGREY formed insert

DURO motor slot cell

DUROK capacitor can liner

BAYRU packing list protector

THEY'RE ALL USING BM-9725* -ANOTHER ROGERS-BORD

INDUSTRY hands this ROGERS-BORD to its customers in ever-increasing quantities. Made exclusively for Bakelite Corporation and identified as BAKELITE molding plastic BM-9725, it is a high-strength thermo-setting plastic used for a multitude of products requiring extra ruggedness.

While ROGERS does no plastic molding, its complete Fabricating Division helps molders by producing BM-9725 blanks of correct weight and thickness and proper shape for easier molding. ROGERS has thus simplified production of many kinds of high-strength plastic articles.

And, as shown in the panel above, other ROGERS-BORDS — plastic and non-plastic — can be formed, drawn, punched and shaped by ROGERS into a wide range of components.

To learn more, check and mail:

- ☐ Send me the ROGERS EXHIBIT BOX, containing fabricated parts and samples of Rogers-Bord.
- ☐ Have a Rogers representative bring samples and fabricated parts.
- ☐ We are enclosing blueprint for suggestions and quotation.

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Formerly
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109 Mill St. Manchester, Conn

*BAKELITE BM-9725
PRODUCTION STEPS

MANUFACTURING	FABRICATING BY ROGERS	MOLDING
Phenolic resin and cellulose fiber sheets.	Sheets blanked to molders' requirements.	Knife handle molded from blanks.

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ROGERS
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Does Your Business Need

"AN ADVENTURE IN IMAGINEERING?"

An adventure in "Imagineering" is a tough molding job that calls for our special brand of imagination plus engineering skill. That's where we excel. We really enjoy having our "imagineering" skill in extrusion and injection molding put to a real test. But in spite of our natural delight in tackling tough jobs, we treat every job as an adventure in "imagineering." There is no job so simple that it does not deserve painstaking engineering attention. There is no job so complex that we won't stretch our "imagineering" talents to the limit to accomplish. Let us take an adventure in "imagineering" with your products. The results will be certain to please you. They may even amaze you.

Write on your letterhead for the new Injection Molded and Extruded Plastics catalog. Or, for detailed information about [illegible]* pipe, tubing and fittings, write for circulars containing data and illustrations.

*Trade Mark, Reg.

ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Crystallite, Polystrene, Styron, Lustron, Loalin, Vinylite, Geon, [illegible],* Saran and Other Thermoplastic Materials

153 WEST HURON STREET • CHICAGO 10, ILLINOIS

When the designer of Formica laminated plastic "Realwood" placed a clear transparent layer of plastic over a lamination of plastic impregnated genuine veneer and united them in marriage with heat and pressure it is not recorded that he actually said "I now pronounce you man and wife".

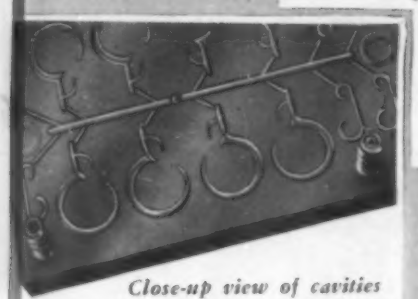
But it is a matter of record that no protecting sheet of plastic has ever divorced itself from a Formica "Realwood" wood veneer base. The oldest installations of "Realwood" have only been in use 10 years, but there is every reason to believe that the full bridal beauty of "Realwood" will be cherished and protected as long as the architect and building in which he uses it both shall live.

Formica is protected from moisture, from checking, chipping, or spotting, and from visible abrasion by ordinary wear. It comes in wood finishes, several fabric finishes, and other colors that never fade.

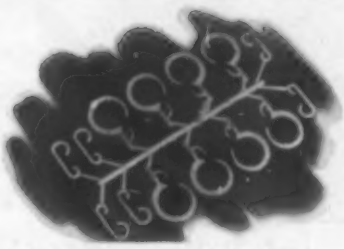
FORMICA

The Formica Insulation Company • 4673 Spring Grove Ave., Cincinnati 32, O.

Could you Mill this 14 Cavity Mold complete in 52 Hours?



Close-up view of cavities in the solid mold block



Plastic shower-curtain hooks in multiple, as they come from the mold.

Photos — Courtesy The Kampa Manufacturing Co.

1000-PC

This 14-cavity plastic mold is a "sticker" if you try to produce it by ordinary methods — but read this report of its production with the Milwaukee Rotary Head Milling Machine!

The Milwaukee Rotary Head method made it possible to set up both halves of this shower curtain hook mold on the machine table. One cavity of each shape was then laid out by means of a scriber held in the machine spindle. Each milling operation was first performed on the location of the layout and then repeated for each additional cavity. Uniform and unvarying precision is repeated by this multiple origination of cavities with the Rotary Head Method. Total milling time complete — 52 hours.

Write for Bulletin 1002-C for full information on this unusual machine tool and the Rotary Head method of milling.

BUILDERS OF MILWAUKEE ROTARY HEAD MILLING MACHINE • MIDGETMILL • SPEEDMILL • FACE MILL GRINDER • AUTOMETRIC JIG BORER • CENTER SCOPE.

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Products

CORPORATION

Milwaukee 14, Wisconsin

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MAKE US YOUR *Plastics* DEPARTMENT

Eye Appeal!

This beautiful Tenite door latch plate greatly improved the appearance of a refrigerator. Do you have an appearance or cost problem that we can help to work out?

INJECTION MOLDING
MINCOR
"YOUR PLASTICS DEPARTMENT"

MINNESOTA
PLASTICS CORP.
366 WACOUTA STREET
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Manufacturers of quality products, with complete facilities for injection molding — Research, engineering, product and model design, tool and die making — press capacity 2 to 16 ounces — printing, machining, fabricating and assembling departments.

Magic Chef

ANNOUNCES A GAS RANGE DESIGN COMPETITION

with $18,000 in Cash Awards

FOR THE BEST DESIGNED GAS RANGE OF TOMORROW

Grand Award	$5,000
Second Award	$3,000
Third Award	$2,000

Fourth, fifth and sixth winners will each receive award of $1,000. The next 10 contestants will each receive award of $500. Contest ends midnight March 4, 1946.

Send the coupon and we'll send you this book of rules

Competition open to

ARCHITECTS • ENGINEERS • ARTISTS DRAFTSMEN • STUDENTS AND OTHERS

with the exception of employees of the American Stove Company, and its subsidiaries, The Architectural Forum, and advertising agencies which serve the American Stove Company and its subsidiaries, and the families of all such employees, or employees of other range manufacturers.

Magic Chef

GAS RANGE DESIGN COMPETITION

SPONSORED BY THE ARCHITECTURAL FORUM 350 Fifth Ave., New York 1, N. Y.

WINNERS WILL BE NATIONALLY PUBLICIZED

GEORGE NELSON, A.I.A., Professional Advisor, c/o The Architectural Forum, Dept. M Empire State Building, 350 Fifth Ave., New York 1, N. Y.

I intend to enter the Magic Chef Design competition. Please send me the program, including the conditions governing the competition and awards.

Name_____

Firm (if any)_____

Address_____

City_____ State_____

Check one: Architect_____ Designer_____ Draftsman_____ Student_____

Other Occupation_____

PLASTIC PARTS

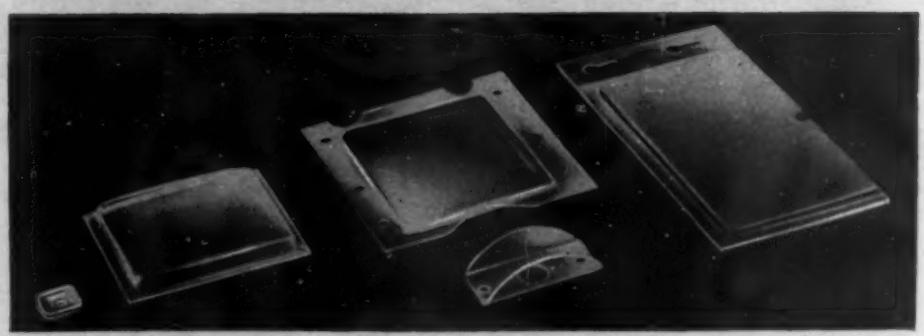
. . . . PRODUCED TO YOUR SPECIFICATIONS

PRINTING
DIE CUTTING
CEMENTING

Wide experience by all known processes in the application of printing, engraving, silk screening, die cutting and cementing of all thermoplastics.

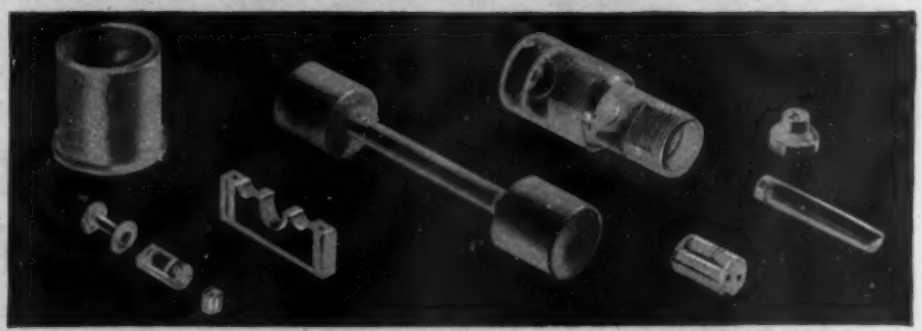
FORMING

Specialists in deep drawing radio dial windows, embossing, swaging and bending in Acetate, Vinylite and Acrylics.



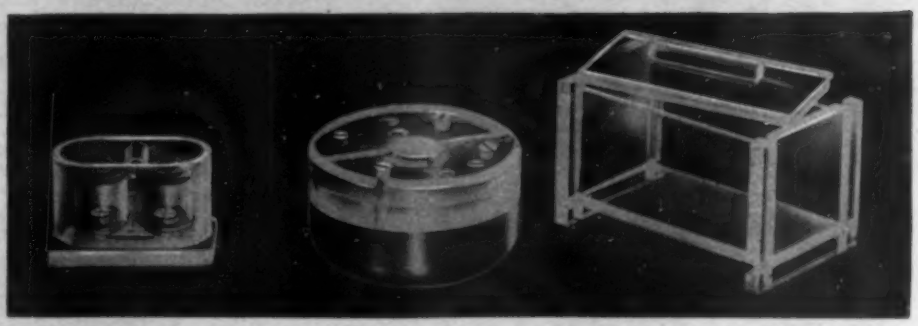
MACHINING

Precision threading, screw machine, milling, drilling, turning of Polystyrene, Acrylics, Phenolics, Nylon, Tenite; sheets, tubes and rods; through spindle capacity up to 2½" rod.



ASSEMBLY

Our engineers can assist you in problems of design and assembly of your plastic units.



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NIXON NITRATION WORKS • NIXON • NEW JERSEY

Glycerine *Rates High In New-Product Planning*

—Here's Why!

GLYCERINE, known to so many chemists in so many different fields, is high on the list in plans for new products because it has *the right combination of properties.*

For instance, its *viscosity* is high and uniform. Its high degree of *permanence* is of value in many industrial fields. Its *wholesomeness* is proved in foods, confectionery, ice cream, cosmetics, drugs, transparent wrappings. It is useful for this reason in textiles, too, especially where products touch the skin.

The *chemical reactivity* of glycerine is an advantage—in the making of alkyd resins and monoglycerides for paints; ester gum for varnishes; polyglycerols and chlorohydrins valuable in the food, drug, and resin industries.

The *humectancy* of glycerine is another advantage—in the processing of tobaccos, as an ingredient in cosmetics, foods, confectionery. Few materials offer such a *combination of properties* advantageous to the manufacturer.

Perhaps glycerine can be of value to *you*. For further information, write: Glycerine Producers' Association, N-1, 295 Madison Avenue, New York 17, N. Y.

Research Laboratories, Chicago, Ill.

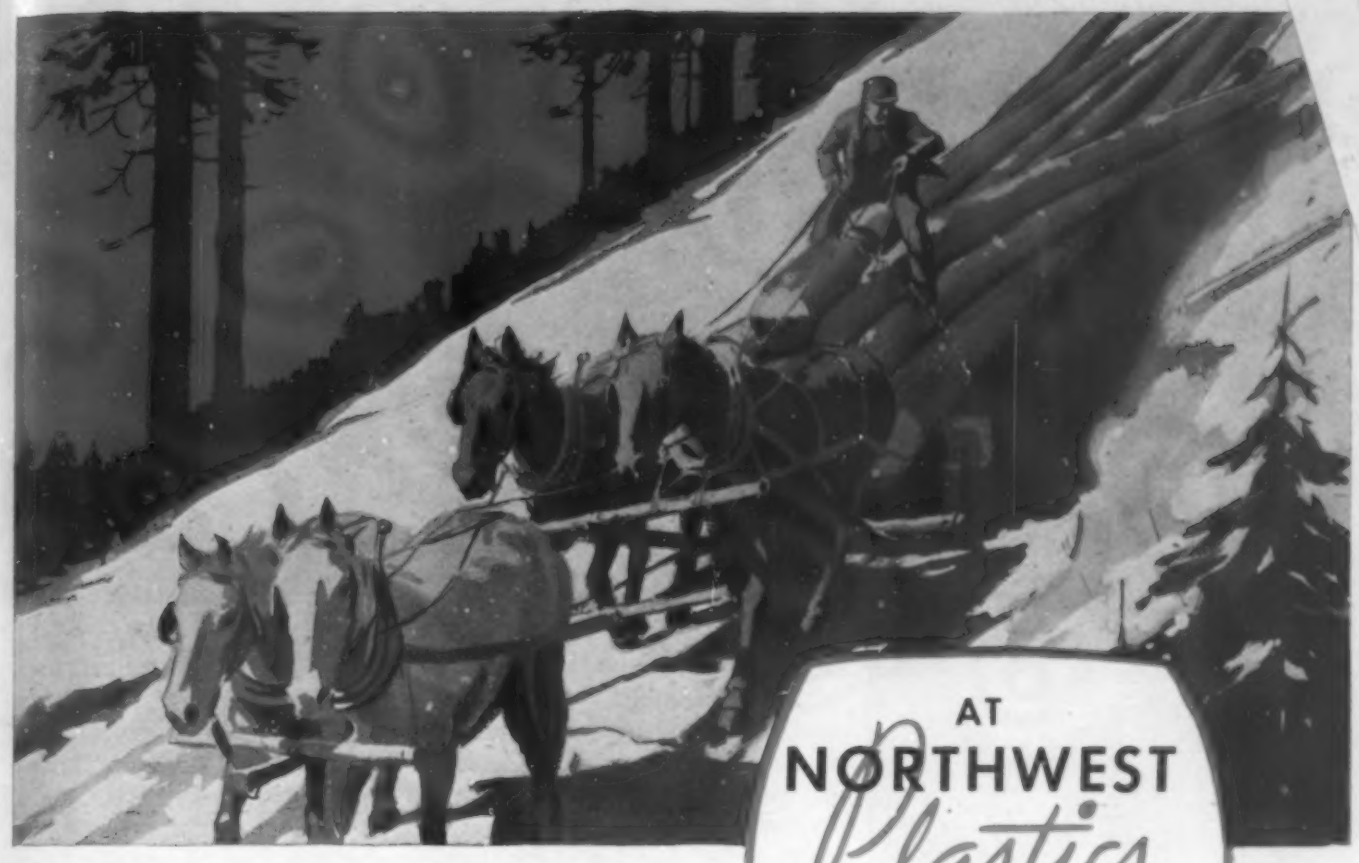
LONG LASTING! Glycerine helps to give products long life—keeps them from drying out easily. Think of glycerine when you plan new products.

HIGH VISCOSITY! The viscosity of glycerine is a standard. That is one of many reasons why this pure, wholesome, versatile material is so valuable in the making of *cosmetics*, such as leg make-up, creams and lotions.

WHOLESOMENESS! Crystal-clear U.S.P. glycerine has real food value, substantially equivalent to carbohydrate. Naturally sweet. Use it in *cakes, candies, soft drinks, flavorings!*

CHEMICALLY REACTIVE! Many useful chemicals can be made from glycerine. Alkyd resins, ester gum, monoglycerides, polyglycerols, and chlorohydrins are a few.

HUMECTANCY! Glycerine solutions do not markedly differ from glycerine itself in humectant powers. A little goes far. To keep a product like *tobacco* moist, use glycerine.



"WE HAVE A HERITAGE OF ACHIEVEMENT!"

Production of essential peace time plastic products is being pushed vigorously at Northwest. New and improved equipment, materials, tools and methods are being used with daring originality. The history of this company is rich in experience gained from several years of outstanding war production.

Northwest Plastics, alert to the possibilities of greater things ahead, invite concerns interested in tomorrow's molded plastics, to confer with their engineering and development departments. No obligation of course.

Northwest Plastics, Inc., 2233 University Avenue, St. Paul 4, Minnesota.

Compression molding · Transfer molding · Injection molding · Extrusion molding
Modern Tool and Die Department · Finishing, Fabricating and Assembling Department
Laboratory for Development and Production Control · Engineering and Product Design

SOCIETY OF THE PLASTICS INDUSTRY SPI

NORTHWEST PLASTICS inc.

The advantages of selecting a molder with facilities for *both* RUBBER *and* PLASTICS

Rubber, one of the oldest plastics, has, with the development of synthetic formulas, become one of the newest. Other new plastics constantly emerge and increase the choice of materials for a product.

It might pay you to select a molder with that wide range of interest in plastics, one who has the research and engineering facilities to help you find the right material.

CHEMICAL RESEARCH AND TESTING

SEMI-SCALE CONTROL AND RESEARCH PLANT

MICRO-PHOTOGRAPHY EQUIPMENT

SOMETIMES the choice of material for a part or product is easy. Other times it involves painstaking matching of the properties of a number of available materials against the specifications dictated by the chemical, optical, electrical or fabrication requirements the product may have to meet. Whether the material should be metal, plastic, hard rubber or soft rubber or a combination of two or three of them depends on the complexity of those requirements. Whatever they are, we believe we are in a good position to help you select the best and most recently developed material for your product, or, should your product require it, to develop a special rubber or plastic compound for it.

We have the completely equipped chemical and physical laboratories for all necessary research and testing. And our trained staff of engineers and technicians is backed by our sixty years of molding experience that started with hard rubber. They have helped in the development of many plastic and rubber products for various industrial and commercial fields.

Special compound for specific job

For instance, our laboratory developed a special compound when the problem of selecting the right material for an electrical connection coupler became difficult. At first a combination of metal and phenolic was tried but, under test, it was found that the coupler shorted when it was subjected to water or damp weather. Rubber was then tried but none of the compounds available at the time had the range of physical characteristics necessary to meet all field and connection conditions. Our research department then

CHEMICAL AND PHYSICAL RESEARCH AND TESTING

The above pictures show various parts of our modern, fully equipped laboratories where our trained staff tests and develops rubber and plastics materials to meet our customers' specifications. These laboratories have been largely responsible for the close tolerance work we have been able to maintain on a wide range of products.

developed a special rubber compound which was able to match the specifications of high dielectric strength, very low permanent set, low power factor, etc., and at the same time had the specific compressibility to make a tight seal and the other physical characteristics for varied field service.

There are, of course, a vast number of applications where plastics are superior or where combinations are best. New and better plastics are constantly being developed, as are new compounds in synthetic and natural rubbers.

It might pay us both to get together

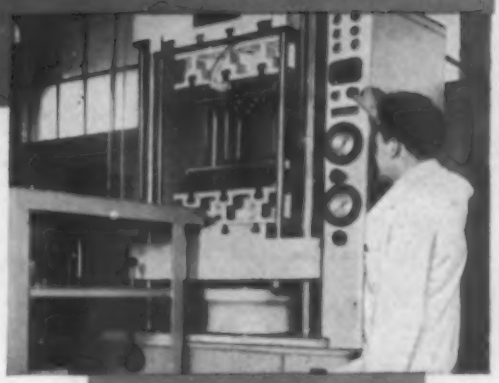
Not only will we be able to help you find the latest and best material, but chances are that our research assistance and facilities for efficient, large-scale production will fill your needs at reasonable cost. Just tell us where and how your part or product has to go to work, or give us the specifications. If we should find that the part or product doesn't belong, economically or physically, in any one of the wide range of plastics, hard rubber, soft rubber, or molding methods that we are set up to handle, we will frankly say so and recommend what we think is best. If you would like to have an engineer call to discuss your needs, please write Dept. C.

Vulcanized Rubber and Plastics Company

formerly . . . The Vulcanized Rubber Company

Manufacturers of Rubber and Molders of Plastics

General Offices: 2 East 29th Street, New York 16, New York Works: Morrisville, Penna.



150 TON AUTOMATIC HYDRAULIC MOLDING PRESS

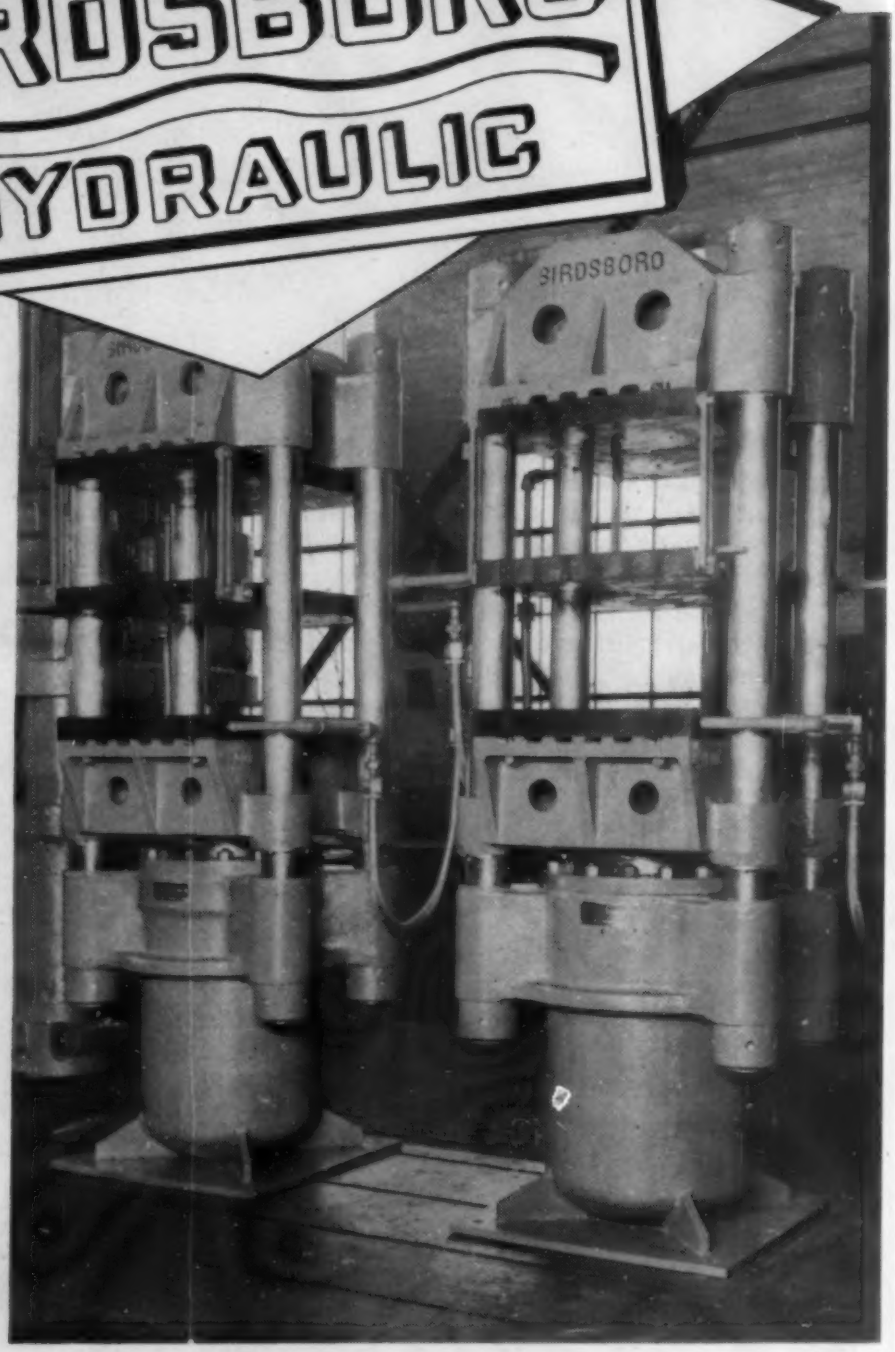
POWER FACTOR TESTER

MOISTURE TESTER

QUALITY CONTROL AND MOLDING RESEARCH

In addition to the laboratories, quality control is maintained in a semi-scale plant. Materials are tested for behavior under operating conditions and better fabricating methods are developed. In equipment such as the 150 ton fully automatic hydraulic press shown here, the best molding method for a customer's part or product is determined.

BIRDSBORO
HYDRAULIC



Behind This
TRADE MARK
Stands Faster, More Economical Press Production

Wherever you find this trade mark, you'll find Birdsboro Hydraulic Presses turning out precision parts of highest quality . . . and producing more of those parts per hour.

To get the most per dollar invested when purchasing your next hydraulic press, be sure it carries this trade mark. Skilled Birdsboro engineers are ready to consult with you on your specific press problems.

Birdsboro Steel Foundry & Machine Company, Birdsboro, Pa.

Representatives in: Cincinnati, Ohio; Indianapolis, Indiana; Kansas City, Missouri; Los Angeles, California; Oklahoma City, Oklahoma; Pittsburgh, Pennsylvania; and Tulsa, Oklahoma.

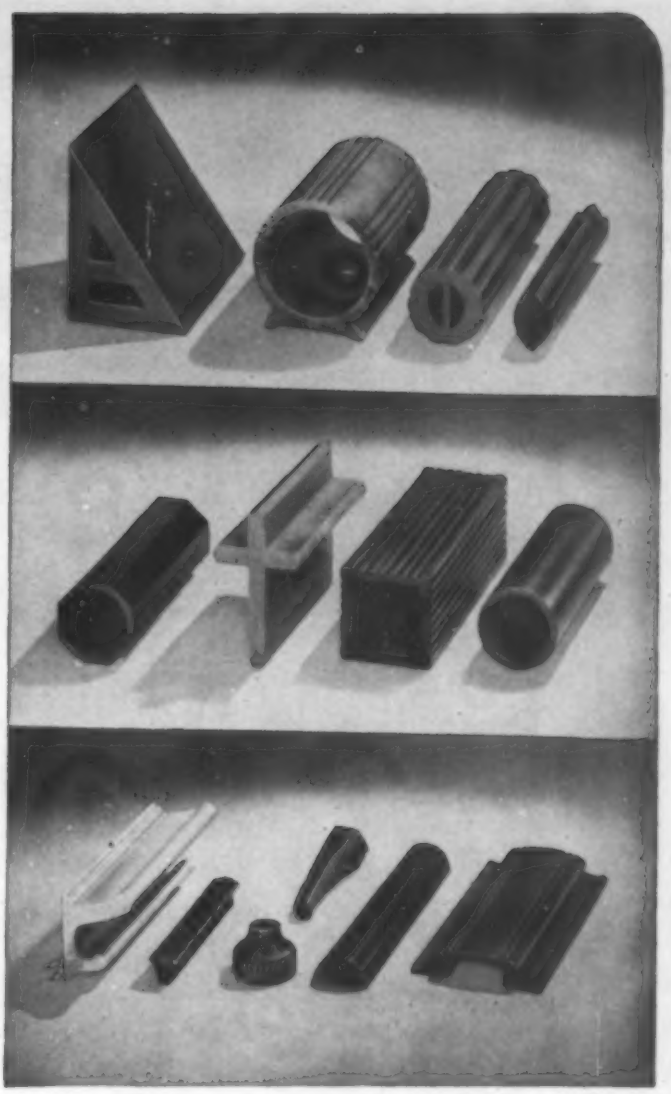
BIRDSBORO
HYDRAULIC PLASTIC PRESSES

MARBLETTE

THE *Versatile* PLASTIC

A CAST PHENOLIC RESIN OF EXCEPTIONAL QUALITIES

- Outstanding among plastics, Marblette has a jewel-like depth and a complete color range which duplicates the appearance of precious stones, tortoise shell and ivory.
- Its almost infinite variety of colors is available in transparent, translucent, opaque, or in mottled effects. Marblette also comes in a waterclear form known as "Crystle" in a wide choice of colors.
- Marblette's machining characteristics, resistance to oil and acids, non-inflammability and exciting beauty make it ideal for countless manufacturing needs.



A few of the many types of Special Marblette castings made to customer's specifications.

SPECIAL CASTINGS

Marblette is supplied in sheets, rods, tubes, and special castings such as cutlery handles, kitchen utensil handles, pipe stems, cigarette holders, clock cases, automotive trimmings, jewelry items, buckles, etc. Special shapes made to customer's specifications can be supplied provided draft is all one way.

MARBLETTE LIQUID PHENOLIC RESINS

Casting Resins for Forming Dies and Tools

Metal Casting Sealing Resins

Bonding Resins

Low Pressure Laminating Resin

Bristle Setting Cement

Laminating and Insulating Varnish

Clear Phenolic Lacquer

MARBLETTE WILL HELP PLAN YOUR WORLD OF TOMORROW

The Marblette staff of engineers offers its services to help with your manufacturing problems. Write to us outlining your needs.

THE MARBLETTE CORPORATION

Manufacturers of Phenolic Resins Since 1929

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Molding Costs Hit A NEW LOW with "RAYCOLITE"

LOW-COST MOLDING COMPOUND

To an increasingly wide range of applications, "Raycolite" macerated resin-impregnated fabric has brought sizable cost savings. In general, it is applicable to phenol-formaldehyde articles of relatively simple design, often involving large areas. We will gladly give you our best advice as to suitability for articles for which you may be considering it.

Ample Working Sample Upon Request

RAYCO COTTON FILLERS

"Research-Fitted" to YOUR needs

RAYCO

Fillers

RAYON PROCESSING CO. of R.I. INC.

Developers and Producers of Cotton Fillers for Plastics

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FASTEN ALUMINUM WITH ALUMINUM
STANDARD SCREW PRODUCTS
ALCOA
ALUMINUM AND ALUMINUM ALLOY
SCREWS · BOLTS · NUTS
RIVETS & WASHERS
Send for this catalog . . . it's Free

Standard aluminum fastening devices, manufactured by Alcoa in various alloys of Alcoa Aluminum, meet the rigid requirements of the many industries assembling aluminum products. A high degree of precision is maintained. They contribute security, light weight, ease of handling, fine appearance and corrosion resistance.

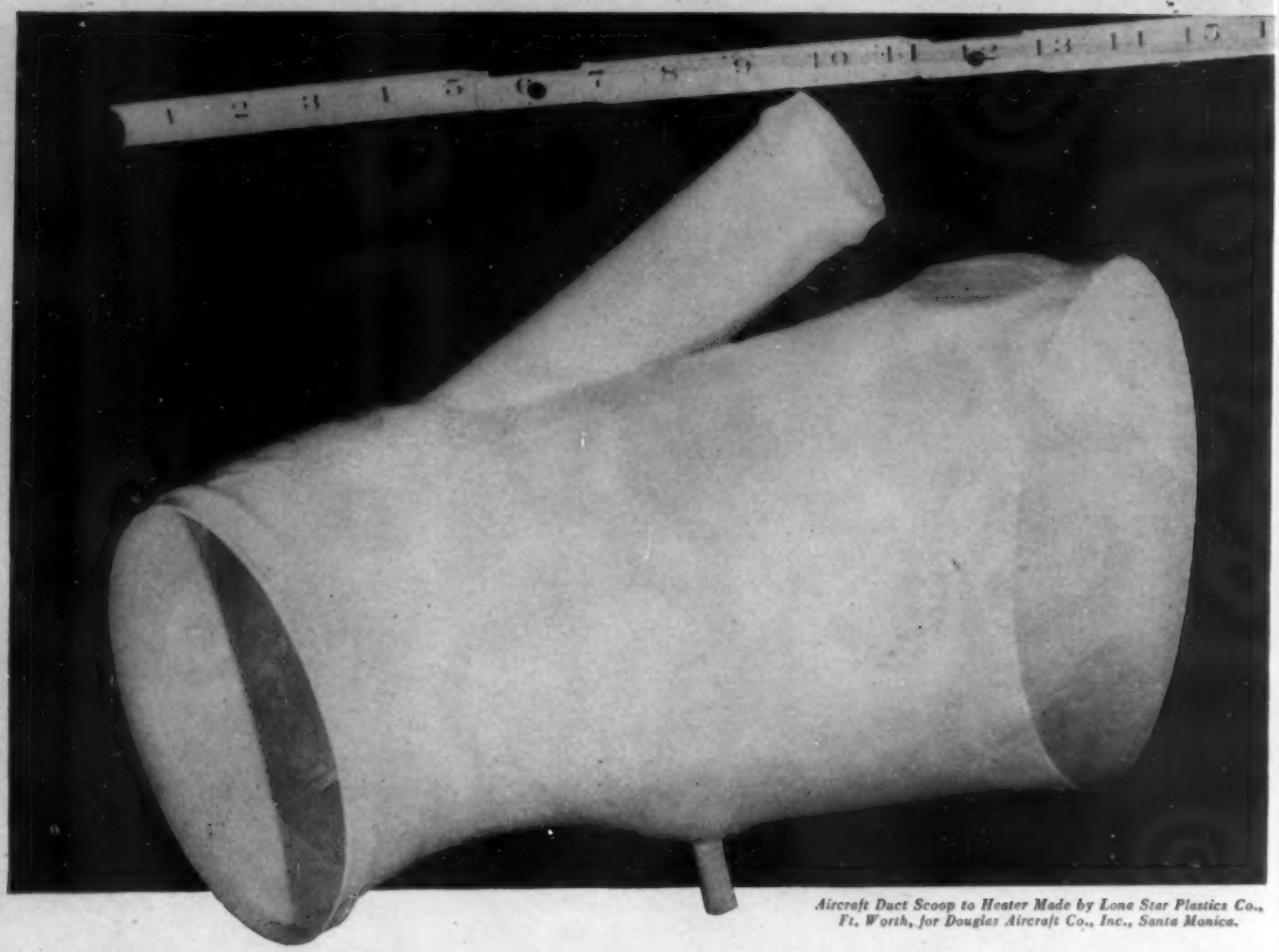
Strong aluminum alloy screws, bolts, nuts and rivets make dependable fastening devices; witness the aircraft using millions of them daily. Include these items in your designs and gain the security which comes from fastening aluminum with aluminum, and the economies obtained by standardization.

Alcoa *standard* screw products are now available in all needed types, sizes and finishes. "Stock" items are carried in warehouse stocks, strategically located throughout the country, by all authorized Alcoa distributors. Where special parts are required, manufacturing facilities are available for producing them.

For a copy of this new catalog, write ALUMINUM COMPANY OF AMERICA, 2175 Gulf Building, Pittsburgh 19, Pennsylvania.

ALCOA FIRST IN ALUMINUM

ALCOA ALUMINUM



Aircraft Duct Scoop to Heater Made by Lone Star Plastics Co., Ft. Worth, for Douglas Aircraft Co., Inc., Santa Monica.

IT HAS 300°F. TEMPERATURE RESISTANCE

. . . another Fiberglas*-reinforced plastics plus value

As an example of the high temperature resistance of Fiberglas-reinforced plastics—ducts for aircraft are being made to withstand 300° F. for 17 hours without serious loss of strength. No other plastics reinforcing material can retain its strength under such temperatures.

The use of Fiberglas Cloth (woven from yarns of fine, strong filaments of glass) as reinforcement for low- or contact-pressure resins, results in laminated sheets, structural and formed parts which possess a *combination of characteristics not to be found in any other material.*

Heat resistance is only one of these properties. Fiberglas-reinforced plastics also have great tensile, compressive, flexural and impact strength per unit of weight; they resist moisture; they are dimensionally stable.

And there's the economy of fabrication to be considered, too. Expensive dies and heavy presses are not required. Large, complicated parts can be laid up and formed in one operation, resulting in a monolith or a monocoque of great strength, yet surprisingly light weight.

Take another look at your product. Regardless of its size, if you are designing for lighter weight; if you want a material that will not dent; if you are confronted with the problem of frequent design changes; if production volume does not justify die costs—then plastics reinforced with Fiberglas may be your answer. It's worth investigating, today. *Owens-Corning Fiberglas Corporation, 1876 Nicholas Building, Toledo 1, Ohio.*

In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.

Owens-Corning Fiberglas Corporation does not manufacture resins or fabricate laminates but will be glad to supply experimental samples of Fiberglas Cloth and data on techniques in its use with plastics.

FIBERGLAS . . A BASIC MATERIAL

*T. M. Reg. U. S. Pat. Off.

LEA Method

LEA Compound

. . . economy keys to desirable high-luster buffing

Northern Industrial Chemical Co., South Boston, Massachusetts —"Moulders of Plastics"—is making these parts for telephone instruments.

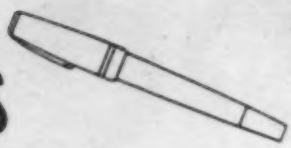
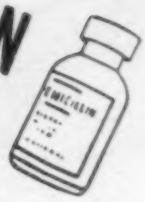
It's in the preparation for the buffing of these parts that the LEA Method and LEA Compound are helping the manufacturer to cut costs and produce better finishes. As stated by this company, "LEA Compound is working out satisfactorily particularly in removing flash on parts which have been rough sanded . . . LEA Compound allows us to produce a high-lustre on the moulded parts."

Being specialists in finishing and having years of experience and many grades of compositions from which to select, our technical men have been called in by hundreds of plants to advise on how to obtain better finishes at lower costs. Northern Industrial Chemical is one of these companies. If you have any finishing or burring problem in connection with metal, plastics or other non-metal parts, ask LEA how to do it best.

THE LEA MANUFACTURING CO.

Waterbury 86, Conn.

Burring, Buffing, and Polishing . . . Specialists in the Development of Production Methods and Composition

FROM PENS  TO PENICILLIN 

Stokes serves Industry in a variety of ways.

It is our good fortune to have grown up with the machine age, assisting in some measure in the industrial development of America during the past half-century.

Over the years we have had the privilege of working with some of the country's foremost scientists, engineers and manufacturers in developing new and better products and production methods. We have contributed our own skills in engineering original equipment.

Among other things, we pioneered in Completely Automatic Compression Molding of thermo-setting plastics — a method that effects great production economies in molding thousands of different parts from pen caps to switch box covers.

Ten years ago we assisted in engineering the first special high vacuum equipment which today makes it possible to produce in large volume the desiccated blood plasma, penicillin and other labile biologicals so vital in saving lives throughout the world. In other fields, too, Stokes equipment is well known and widely used . . . for all high vacuum processing methods, for manufacturing pharmaceuticals, for compressing powder metals, in the fields of electronics and nuclear physics, and in other industries.

It shall be our continuing endeavor to serve Industry well. We look toward the future with hope of rendering even greater service in the years to come. F. J. STOKES MACHINE CO., 5934 Tabor Road, Philadelphia 20, Pa.

50th YEAR

of Service to Industry

F. J. STOKES

Est. 1895

Pioneering in Automatic Compression Molding of Plastics . . . Powder Metals Compacting . . . Dry-Pressed Ceramics . . . High Vacuum Processing . . . Desiccation from the Frozen State . . . Water Distillation . . . Pharmaceutical Technique and Equipment.

THEY'RE GETTING GOOD RECEPTION ALL-AROUND

RADIO MANUFACTURERS
are getting good reception

Speedy reconversion of MOLDED PRODUCTS facilities is already delivering plastic cabinets in *quantity* to radio manufacturers.

RADIO DEALERS
are getting good reception

Radios "packaged" in MPC plastic cabinets get an enthusiastic reception in retail stores . . . for their clean, sleek lines and colorful beauty

RADIO LISTENERS
are getting good reception

Correctly designed and skillfully produced, MPC plastic cabinets provide a protective housing that contributes to good radio reception over a period of many years.

The production of plastic radio cabinets by MOLDED PRODUCTS CORPORATION, now well into its second million, illustrates two points: First, we have ample experience with volume plastic production. Second, our organization is sufficiently comprehensive for large-scale operation, yet so compact that actual output of new products is quickly achieved. Submit your plastics product or problem . . . *now* . . . to MOLDED PRODUCTS CORPORATION, 4533 W. Harrison St., Chicago 24, Ill.

MOLDED PLASTICS CORPORATION MPC DIVISION PRODUCTS

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OF FILMS FOR ALL USES

PLASTIC FILM CORPORATION

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improved properties with . . .

Flexol PLASTICIZER DOP

★ *Permanence of flexibility—*

★ *High tensile strength and tear resistance—*

★ *Excellent low temperature flexibility—*

★ *Freedom from plasticizer "sweat-out"—*

These and many other improvements in plasticized resinous materials have been made possible by the use of "Flexol" plasticizer DOP and other plasticizers supplied by Carbide and Carbon Chemicals Corporation.

"Flexol" plasticizer DOP (diethylhexyl phthalate) is a water-insoluble, non-volatile liquid with excellent heat and light stability, good electrical properties, and wide compatibility with resinous materials.

Five years of use as an all-purpose plasticizer for the vinyl resins has proved the outstanding value of "Flexol" DOP.

In nitrocellulose and ethyl cellulose lacquers, "Flexol" DOP has durability as well as excellent heat and light stability, and efficient plasticizing action.

In synthetic rubber, "Flexol" DOP develops high tensile strength, resilience, and low-temperature flexibility. It has a neutral effect on cure.

Write for the booklet "Plasticizers." Our technical representatives will be glad to help you choose the plasticizer that will give you the properties you desire.

OTHER PLASTICIZERS

In addition to "Flexol" DOP, Carbide and Carbon Chemicals Corporation supplies a varied group of plasticizers designed to fit important industrial requirements. These include:

"Flexol" plasticizer 3GH
"Flexol" plasticizer 3GO
"Flexol" plasticizer 4GO
"Flexol" plasticizer 8N8
"Flexol" plasticizer CS-24
"Flexol" plasticizer TOF
Dimethyl Phthalate
Dibutyl Phthalate

Buy and Hold United States Victory Bonds and Stamps

SYNTHETIC ORGANIC CHEMICALS

CARBIDE AND CARBON CHEMICALS CORPORATION

Unit of Union Carbide and Carbon Corporation

UCC

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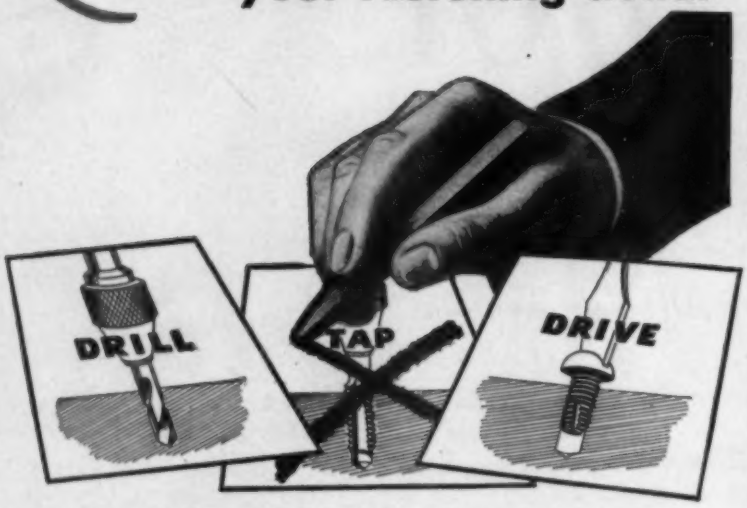
"Flexol" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

TAKE THIS

Short Cut to Better Assemblies

...and save up to 50¢ on your fastening dollar



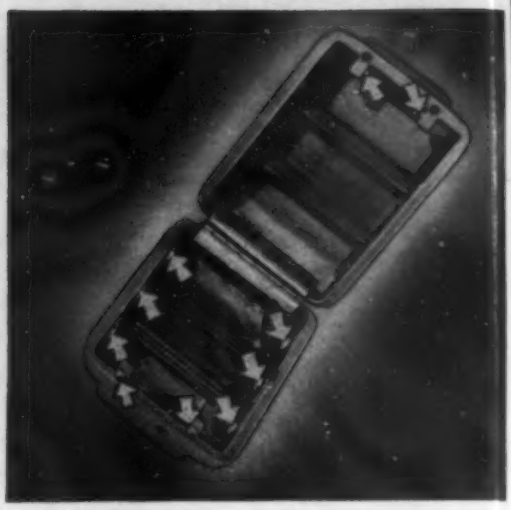
A FASTENING OPERATION BECOMES SIMPLY "DRILL-DRIVE", instead of drill-tap-drive, when you change over to P-K Self-tapping Screws. You eliminate tapping for machine screws . . . end fumbling with bolts and nuts . . . avoid troublesome inserts in plastics, and do away with riveting in hard-to-reach places.

BESIDES SAVING YOU FROM 30% to 50% in fastening time and labor, the P-K "shortcut" method turns out a stronger assembly, because the extruded threads that are formed as P-K Screws are driven hold securely, and resist the severest vibration.

YOU CAN CHANGE to P-K Self-tapping Screws over night. No special equipment or special training of help is needed, although the "short cut" method often permits the use of power, in place of hand drivers.

CALL IN A P-K ASSEMBLY ENGINEER. He'll help you find all opportunities for saving time and money, and improving your product, with P-K Screws. Or, mail assembly details direct for recommendations. Parker-Kalon Corporation, 208 Varick Street, New York 14, N. Y.

SOLD ONLY THROUGH ACCREDITED DISTRIBUTORS



P-K SCREWS HELP INSTRUMENT MAKER SPEED UP PRODUCTION — CUT COSTS!

By using P-K Type "Z" and Type "U" Self-tapping Screws to replace machine screws in tapped holes, as a means of securing contacts and clips to a Tenite battery case, E. A. Myers and Sons report an increase of 30% in production speed and a saving of 50% in assembly time and labor. Countersinking of 3 contacts, tapping in cramped places, and stripped threads are eliminated, and fastening strength is double that resulting from the former method.

"HOW TO USE" BOOKLET — FREE on request — will give you quick facts on all the P-K Self-tapping Screws and other Fastening Devices . . . tell you where and how to use them. Write for a copy . . . ask for Form 480.

PARKER-KALON
Quality-Controlled
SELF-TAPPING SCREWS

For Every Metal and Plastic Assembly

IMPREGNATING?

LAMINATING?

BONDING?

ADHERING?

...better investigate what Resinox Industrial Resins can do for you

So numerous and so diverse are the successful applications of Resinox* Industrial Resins that Monsanto feels it can logically ask almost any manufacturer in these fields to examine both his methods and materials for possible improvements via these versatile thermosetting phenol-formaldehyde resins.

Here, for example, are just a few of the Resinox resins with which Monsanto has helped other manufacturers meet specifications, improve products or surmount production difficulties:

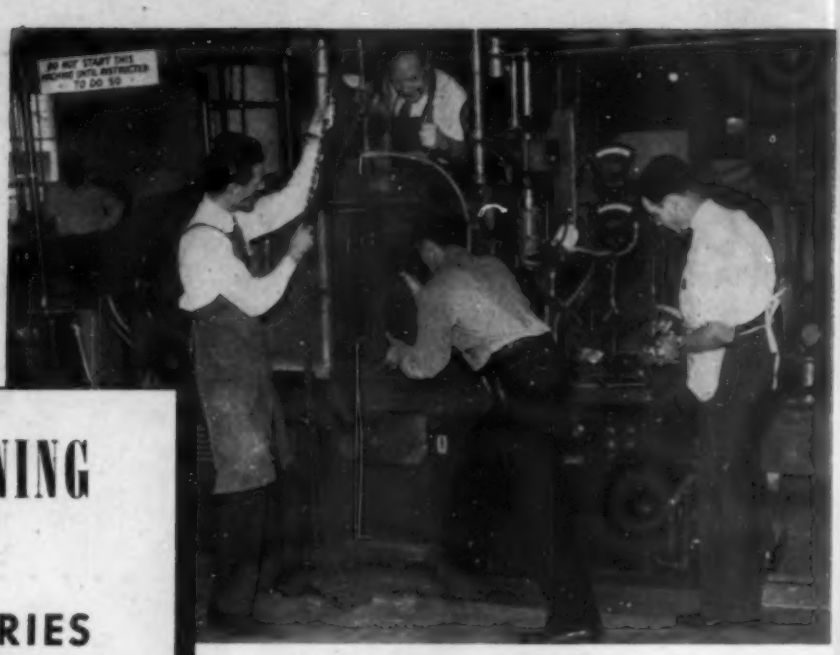
- . . . a special Resinox Industrial Resin for a new, more resilient, resinoid grinding wheel.
- . . . a laminating resin for light-weight corrugated floor boards for aircraft.
- . . . a resin for setting insulating material into easy-to-handle batts.
- . . . impregnating resins for plastic-paper overlays on plywood.
- . . . resins for bonding phenolic molded parts, wood veneers, papers, pulp, etc.
- . . . resins for use with sisal fillers, pulp molding resins and a host of other applications.

These are just a few of the jobs Monsanto's Industrial Resins are doing every day. Many of the applications have been worked out between the manufacturer and Monsanto's own industrial resins technicians and researchers. Perhaps the same combination can serve you advantageously, too. For full information write, wire or phone MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Mass.

*Reg. U. S. Pat. Off.

For free consultation on any Industrial Res'n . . . or any Plastic problem inquire about MONSANTO PLASTICS TECHNICAL COUNCIL, EOW.

MONSANTO
PLASTICS
SERVING INDUSTRY...WHICH SERVES MANKIND



Students installing a mold in an injection molding machine at Plastics Institute.

PRACTICAL TRAINING

as featured at

PLASTICS INDUSTRIES TECHNICAL INSTITUTE

Training at Plastics Industries Technical Institute is practical, comprehensive . . . designed for the man who wishes a complete, intensive and specialized preparation for a place in the plastics industry.

Students at Plastics Institute are given definite projects as part of their training. They learn the steps in the production of plastics articles by actual practice. Each student is encouraged to develop his individual initiative and ability.

The training proceeds from the testing and selection of raw materials through design and drafting, to commercial production methods and final finishing and testing. Laboratory and shop equipment at Plastics Institute is similar to that found in the industry, it provides machinery and materials for the student to learn molding, testing and fabrication by actual practice.

The importance of practical instruction has been proved by the numerous Plastics Institute students throughout the United States and from 16 foreign countries who have become successful in the industry. Your inquiries regarding both the Home Training and Resident Technology courses are welcomed.

VETERANS ELIGIBLE FOR G. I. TRAINING

A number of World War II Veterans are taking advantage of the educational provisions in the G. I. Bill of Rights to receive practical training at Plastics Industries Technical Institute. To any of your former employees returning as veterans or to any other servicemen who are interested in obtaining plastics education—we will be happy to send information explaining their privileges and details concerning our training program. Please write us.

Plastics
INDUSTRIES TECHNICAL
INSTITUTE

Francis A. Gudger, President - John Delmonte, Technical Director

WRITE DEPT. MP5-12

NEW YORK
122 EAST 42ND ST.
NEW YORK 17, N. Y.

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LOS ANGELES
1601 SOUTH WESTERN AVE.
LOS ANGELES 6, CALIF.

WE FABRICATE BOTH WITH EQUAL FACILITY HERE AT BEND-A-LITE

Our idea of turning out a good job is to take a set of specifications and produce both "dangerous" curves and the sharpest angles so that the finished product elicits praiseworthy attention from even a casual look.

Just as we produced highly difficult "curve and angle" jobs for the war effort . . . so can we duplicate this in civilian production.

We welcome your inquiries regarding any type of precision fabrication . . . display fixtures . . . furniture . . . the fabrication of cast phenolics . . . radio cabinets . . . jewelry . . . or any type of production that comes within the scope of modern plastics . . . Where wood and/or metal is used in fabricating, as in the case of certain types of display fixtures, we are equipped to furnish this material and produce the entire job complete.

b

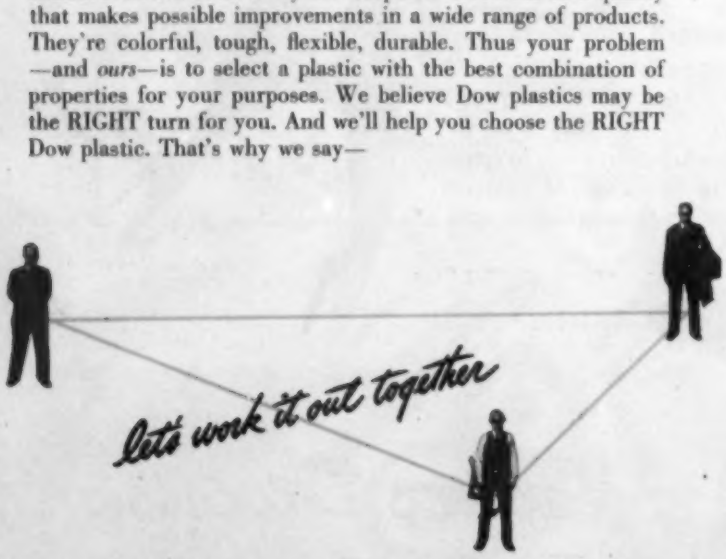
BEND-A-LITE *Plastics Division*

423 SOUTH HONORE ST. • CHICAGO 12

when you turn to Plastics...

TURN RIGHT!

Maybe you're making radio cabinets or bottle caps. Or pens, pencils or paint brush handles. Whatever your products, there are probably Dow plastics you could use to make them better —and at lower cost. But before you set your course in this materials field, be sure you're making the RIGHT turn. Dow plastics are the result of years of development by a company founded on research. They are adaptable materials of a quality that makes possible improvements in a wide range of products. They're colorful, tough, flexible, durable. Thus your problem —and *ours*—is to select a plastic with the best combination of properties for your purposes. We believe Dow plastics may be the RIGHT turn for you. And we'll help you choose the RIGHT Dow plastic. That's why we say—



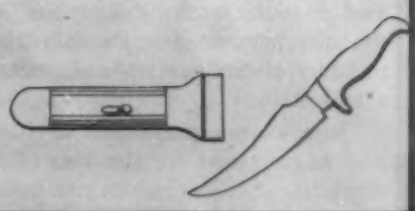
High accomplishment in plastics will result only when manufacturer, designer, fabricator and raw materials producer put their skills together, working as a team. In the interests of achievement, therefore, Dow urges you to save time and money by putting its experts to work on *your* problem. They'll do their part.

SARAN

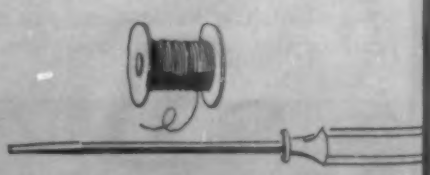
STYRON

DOW

ETHOCEL



STYRALOY 2



Present and Potential Uses:

Plating masks; chemical apparatus; pump parts; valves and valve parts; name plates; meter parts; paint brush handles; insulation, funnels; bottles; closures; plumbing equipment; wire coating, etc.; pipe and tubing for installations requiring chemical and corrosion resistance; monofilament for textiles.

Properties:

Resistant to chemicals, abrasion, corrosion, water, and moisture; good electrical insulator; excellent thermal insulators; non-flammable; tough; flexible; dimensionally stable; not recommended for installations requiring temperature resistance above 170° Fahrenheit.

Present and Potential Uses:

Lighting fixtures; insulators; battery cases; hydrometers; funnels; closures; food handling equipment; pharmaceutical, cosmetic and jewelry containers; costume jewelry; novelties; refrigerator parts; pens; pencils; liquor dispensers; escutcheons; chemical apparatus; lenses; decorative objects, trim.

Properties:

Clear, translucent or opaque; broad color range; excellent high frequency electrical insulator; can "pipe" light through rod at angles, and around corners; resistant to acids and many alkalies; low water absorption; lightweight; stable at low temperatures.

PLASTICS

Present and Potential Uses:

Housings; radio cabinets; aircraft parts; containers; insulators; flashlights; automotive parts; escutcheons; refrigerator parts; tool handles; rods, tubes, bars, and special extruded shapes for kitchen trim; automotive and aircraft window frames; modern window blinds. Also used as tape and wire coating.

Properties:

Extra tough, particularly at low temperatures; attractive colors; pleasant to handle; transparent or translucent; dimensionally stable to varying climatic conditions and temperatures; light in weight; available in wide range of flow; not available in crystal color; limited chemical and solvent resistance.

—new Dow-developed synthetic elastomer now commercially available. Produced originally for special electrical applications, its many unique qualities point to a much broader range of uses.

Present and Potential Uses:

One-piece cable sheathing; handles for tools; household appliances, etc.; gaskets; bushings; coil forms; floor mats; scuff plates; many applications still to be ascertained.

Properties:

High dielectric strength, low power loss over all frequencies. Power factor only .005 at 100-300 megacycles. Flexible and shock resistant from −90° F. to 212° F. Specific gravity less than 1. Water absorption only 0.2 to 0.5%. Resists heat, ozone, most chemicals, abrasion, permanent indentation. Ideally suited to extrusion of complex cross sections and readily fabricated by other techniques. Easily machined.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
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DOW
PLASTICS

STYRON • STYRALOY • ETHOCEL
ETHOCEL SHEETING • SARAN • SARAN FILM

DESIGNING is as important in plastics as your designs on consumer purse strings!

There's no better time to get "down to cases" than in the planning stage. Final product acceptance is often pre-determined by first-hand "on-the-line" knowledge of user habits, customs and living . . . what the product will do for the consumer to urge its purchase. MACK MOLDING experience along these lines is keyed to the production, marketing and saleability of plastic moldings—from low-cost premium items to expensive components in luxury assemblies . . . in small quantities or tremendous volume. This collaboration is available to you, without cost or obligation. Address inquiries to Mack Molding Company, Inc., 120 Main St., Wayne, New Jersey.

IS IT PRACTICAL?

Your product will travel in fast company in this highly competitive market. Design it to meet a need—the greater the need, the better the sales potential.

DURABLE?

Want repeat sales or consumer goodwill? Better make your product right the first time. Test it, try it, use it—as many times as you would if you were buying it for yourself.

HOW ABOUT EYE APPEAL?

Looks can kill a sale . . . so pick a material with glamor as well as intrinsic value. Plastic moldings need not be battleship grey to withstand corrosion, acids or heat.

IS IT PRICED TO SELL?

The joker everytime! If you have the idea or plans, we can tell you the score as far as plastic moldings are concerned. That's our job—one we have done for almost thirty years.

WRITE FOR THIS INFORMATIVE

PLASTIC BOOKLET

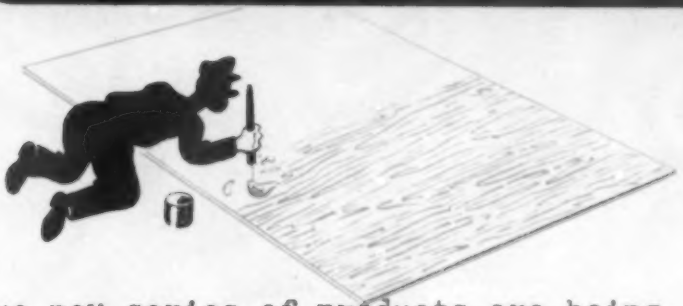
Eight pages of crisp, factual information concerning plastic moldings—profusely illustrated with MACK products used in every type of application—food and drug, automotive, electronics, aviation, furniture, apparel, etc. Send for your copy today.

Mack MOLDED EXCELLENCE

SALES OFFICES: NEW YORK CITY, CHICAGO, DETROIT, INDIANAPOLIS, BOSTON & ST. LOUIS.

PULP AND PAPERS, CUSTOM-MANUFACTURED FOR PLASTICS APPLICATIONS

. . . New Papers for the Plastics Industry



Two new series of products are being offered to the industry in 1946.

They are:

1. STRETCHING PAPERS...coating base stocks of great strength that will stretch 12% without loss of tensile. High fold and tear resistance.
2. PLAIN and PRINTED DECORATIVE SATURATING PAPERS...stock and special designs in cloth and woodgrain patterns.

In addition, we are continuing to manufacture the following custom-built papers.

- ✓Tube Winding Stock
- ✓Electrical Papers
- ✓Wide range of Saturating Papers for special needs of from 2 to 20 mils.

In the manufacture of all grades of impregnating papers and coating stocks, we continue our policy of making papers to satisfy individual requirements.

Once specifications are determined, Munising's precision type of manufacture assures uniform deliveries on subsequent runs-uniform caliper, formation, finish, density.

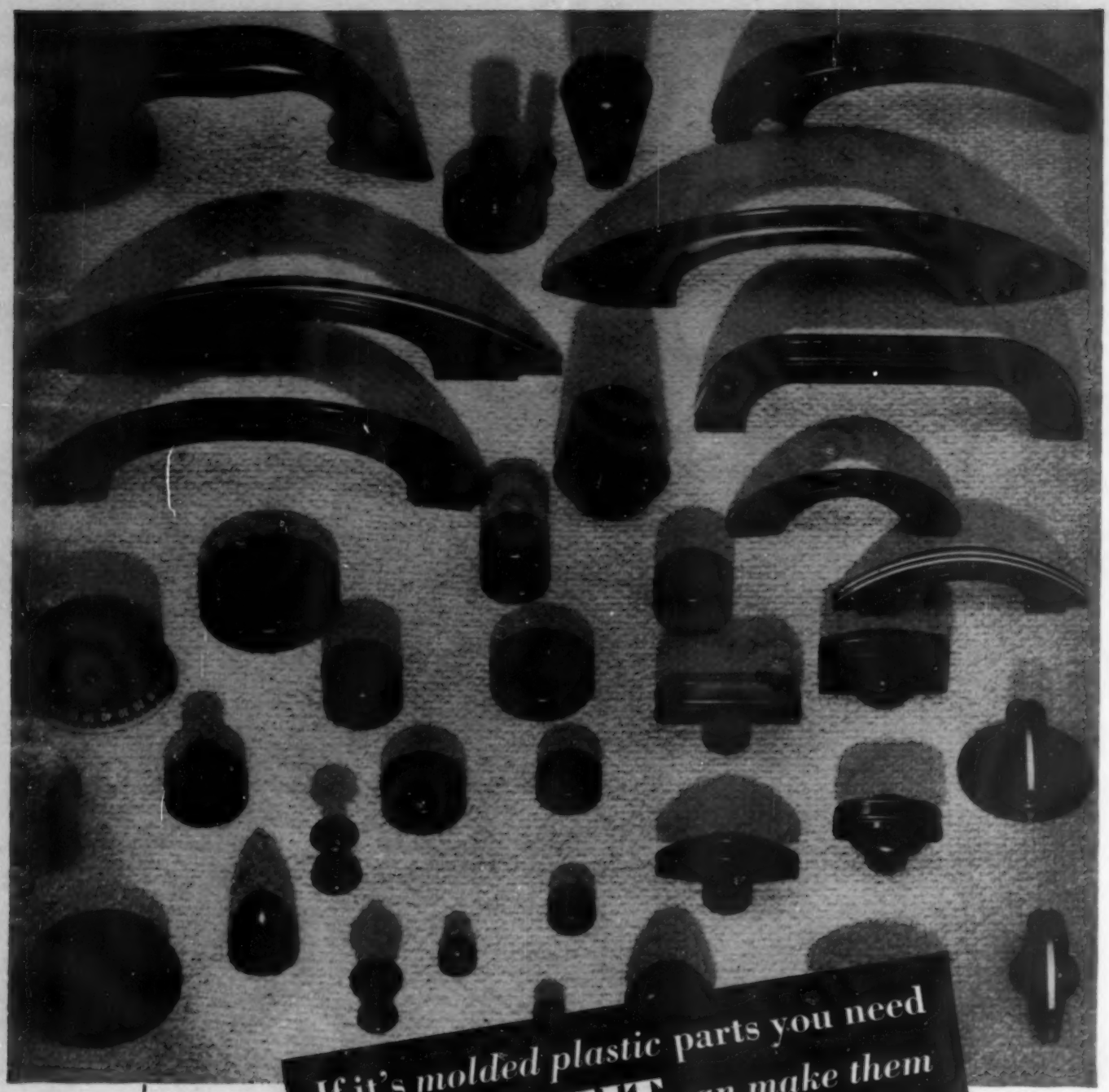
Precision-Made Resin Impregnating and Coating Base Stocks with **UNIFORM** Density Formation Caliper

The Munising Paper Company

Sales and Executive Offices • 135 South La Salle Street, Chicago 3, Illinois • Pulp and Paper Mills at Munising, Michigan

MUNISING PAPER

◆ MANUFACTURERS OF PRECISION MADE PULP AND PAPERS FOR MORE THAN 40 YEARS



If it's *molded plastic* parts you need
GRIGOLEIT *can make them*

Our enlarged and improved facilities . . . engineering and designing experience . . . recognition as leaders in molded plastic trim . . . all are at your service to give you the best in product design and manufacturing skill.

At GRIGOLEIT you'll find the newest in either plastic or plastic-and-metal trim . . . an extensive stock line of handles, knobs and parts for appliances, stoves and furniture . . . also a full line of closures for food, drugs and cosmetics. And more . . . a complete service for custom molding of thermoplastic and thermo-setting plastic.

Write for our new 1946 catalog.

THE GRIGOLEIT COMPANY

DECATUR 80, ILLINOIS

PLASTICS TESTING

IS *Quality* INSURANCE

You don't buy insurance because you expect to have a fire... it's simply protection. And the same with a steady program of Plastics Testing. ★ Through Testing you keep your Plastics in the forefront of progress... it tells you whether your Plastics are meeting serviceability requirements... it provides you with the facts you need in purchasing, manufacturing, and selling. ★ The United States Testing Company, Inc., has facilities for Testing Plastics on a chemical, physical, or electrical basis... or to solve problems of practical application. The following is but one of our many special Plastics Tests:

TESTING PLASTICS FOR USE IN INSULATION BOARD

Many new types of Plastics are being considered for insulating purposes. Included are the expanded, molded, laminated, and paper types. Our Tests on Plastics for use in insulation board cover: Thermal Conductivity ★ Resistance to Moisture ★ Resistance to Mildew ★ Resistance to Vermin.

UNITED STATES TESTING COMPANY, INC.

ESTABLISHED 1880

HOBOKEN, NEW JERSEY

PHILADELPHIA, PA. · BOSTON, MASS. · WOONSOCKET, R. I. · CHICAGO, ILL. · NEW YORK, N. Y.

TROUBLES SUBSIDE

It was a slow and troublesome job to drive small slotted screws in fastening a pressed fabric panel on this electrical relay for the P-80 Jet Plane. Frequent driver skids gouged the special fungus-resistant varnish, forced disassembly and junking of marred panels.

OUTPUT HITS STRIDE

Assembly of this part was speeded up 400% when a change was made to Phillips Recessed Head Screws. Fumbling was ended, and a spiral driver could be used, permitting faster driving. Driver skids were eliminated, along with waste of parts and time for disassembly and reassembly.

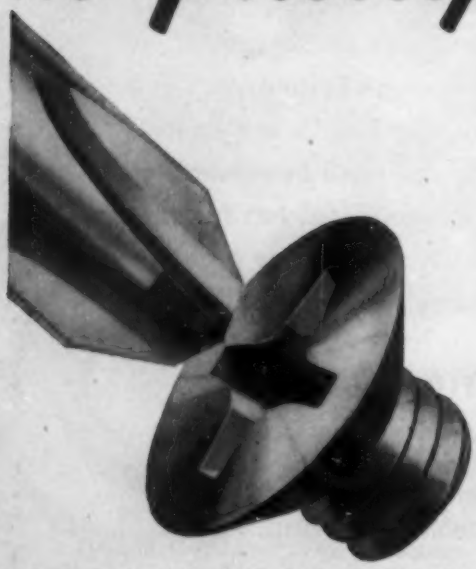
NEW STRENGTH SUPPLIED

Design engineers favor Phillips Screws, because they not only speed output and reduce costs . . . they also permit design improvements that add strength, often with the use of fewer screws. This advantage is especially evident in compact, complicated assemblies.

SHOW IT WITH PRIDE

Wherever screw heads are exposed, the Phillips Recess adds a sales advantage. No unsightly burrs to snag clothing or nick fingers – and sidetrack sales! Its ornamental design blends with modern contours – and it needs only a quarter turn to line up – looks well in any position.

It's Phillips ... the engineered recess!



In the Phillips Recess, mechanical principles are so correctly applied that every angle, plane, and dimension contributes fully to screw-driving efficiency.

. . . It's the exact pitch of the angles that eliminates driver skids.

. . . It's the engineered design of the 16 planes that makes it easy to apply full turning power – without reaming.

. . . It's the "just-right" depth of recess that enables Phillips Screw Heads to take heaviest driving pressures.

With such precise engineering, is it any wonder that Phillips Screws speed driving as much as 50% – cut costs correspondingly?

To give workers a chance to do their best, give them faster, easier-driving Phillips Recessed Head Screws. Plan Phillips Screws into your product now.

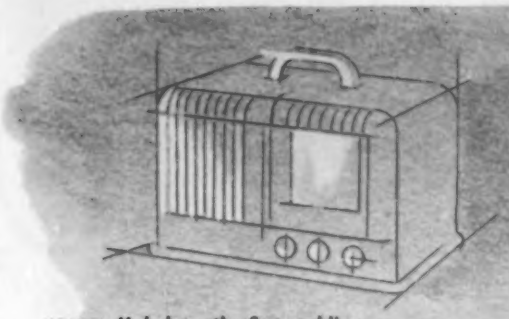
PHILLIPS Recessed Head SCREWS

WOOD SCREWS • MACHINE SCREWS • SELF-TAPPING SCREWS • STOVE BOLTS

Made in all sizes, types and head styles

25 SOURCES

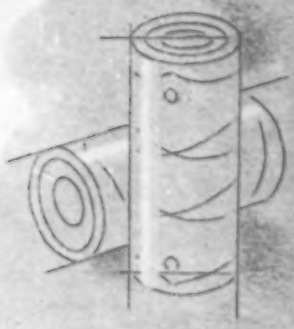
American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.
The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lamson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.
Pawtucket Screw Co., Pawtucket, R. I.
Pheoll Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
The Steel Company of Canada Ltd., Hamilton, Canada
Wolverine Bolt Co., Detroit, Mich.



ABOVE: Makalot—the first molding compound of which large Pilot radio cabinets could be successfully molded—is now a favorite with molders of numerous small and large radio cabinets of which the one shown here is an example.

BELOW: This Universal Winder is the largest and most difficult job of extrusion molding ever done in this country. Molder spent nearly three months attempting to produce it—then tried Makalot—and in 12 hours *Makalot did it!*

ABOVE: Walls so thin in places and thick in others only Makalot could successfully make it.



sketched from originals

QUICK CURE

for Molding "Headaches"

WITH MAKALOT Molding Compounds, leading molders have solved literally *scores* of molding problems in a matter of hours or days—where weeks or months had been lost experimenting with competitive materials.

For difficult molding problems, the answer *today* is Makalot.* Whatever the job requirements, there is a Makalot Compound exactly suited to that application—a quicker-curing, trouble-free material *for high speed production!*

There are low loss Makalot Compounds for high frequency applications, non-cracking for molding around inserts, general purpose, super-impact, X-ray or sweat resistant, or with brilliant surface lustre and color—and—every one has been *proved* in outstandingly successful use by some of the country's foremost molders.

IF YOU HAVE A MOLDING PROBLEM, call on Interlake to supply a Makalot Compound suited to your application. Interlake offers a complete line of Makalot phenol formaldehyde thermosetting compounds—in various forms, in a wide range of flows. Write Interlake Chemical Corporation, Plastics Division, 1911 Union Commerce Building, Cleveland 14, Ohio.

**formerly Makalot Corp., now a unit of Interlake Chemical Corporation, Plastics Division.*

INTERLAKE CHEMICAL
Corporation
• PRODUCTS FROM COAL •

Makalot Plastics

"Pinko" too *has* CONTROLLED ABSORBENCY

The high absorbency of Hummel Ross "Pinko" Paper makes it tremendously interesting to the Plastics Industry for plastic impregnation and in making plastic laminates.

But "absorbency" alone is not enough. "Pinko" also has *controlled* absorbency . . . and is made in various degrees of absorbency, held within narrow limits. Your own laboratories will want to experiment with "Pinko" because of these two important characteristics.

ASK FOR SAMPLES

An inquiry addressed to our Plastics Research Laboratories will bring you samples in various calipers and absorbencies. Feel free to ask for any specific data you desire.

Originators • Creators

HUMMEL-ROSS FIBRE CORPORATION

Hopewell, Virginia, U. S. A.

Free Offer!...with a (small) Catch to it!

IF YOU ARE A BUSINESSMAN with a yen to know more about plastics, you'll want your free copy of this illustrated booklet. It tells what plastics will do. It even tells what they won't do. It tells how to go about getting complete data on your project. It goes on to describe production functions from design through the finishing stages—and how to make use of them.

As for the designer, the design engineer and the professional purchaser—men who know plastics from living with 'em—there's something here for you, too. Not technical data on design or materials—which would only get the once-over-lightly treatment in a booklet like this anyway. We mean information on the kind of thinking and equipment offered by a long-established but progressive molder who would like consideration as your source of supply.

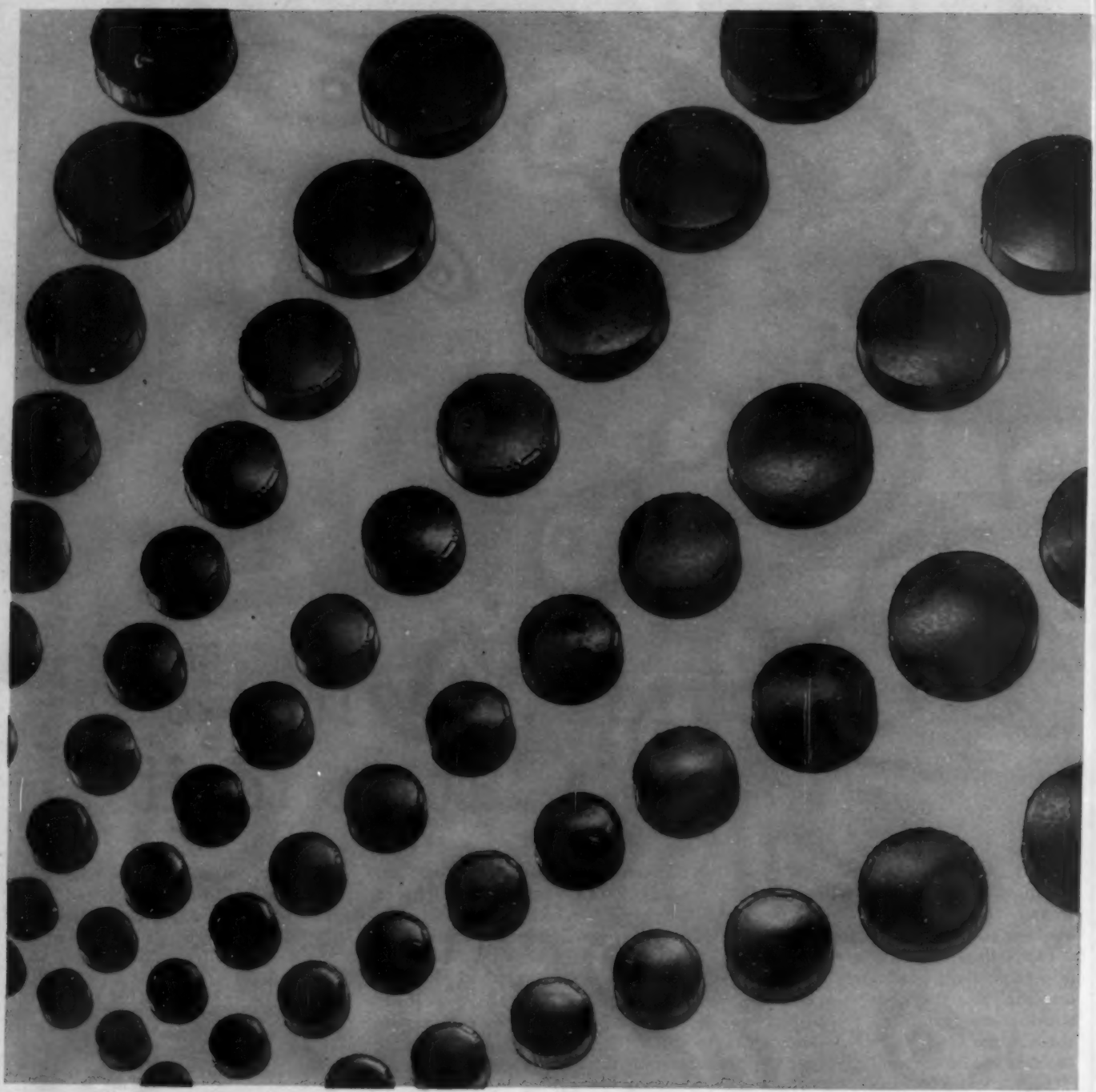
The catch? Well, after you've read it, you may want Kurz-Kasch to figure a job for you. Is that bad? We can name plenty of manufacturers who don't think so. Fill in the coupon and attach it to your letterhead. Get a free copy of "A Businessman's Guide to the Molding of Plastics"—and test *your* will power!

Kurz-Kasch

For Over 25 Years Planners and Molders in Plastics

Kurz-Kasch, Inc., 1415 South Broadway, Dayton 1, Ohio • *Branch Sales Offices:* New York, Chicago, Detroit, Indianapolis, Los Angeles, Dallas, St. Louis, and Toronto, Canada • *Export Offices:* 89 Broad Street, New York City.

Kurz-Kasch Inc., 1415 So. Broadway, Dayton 1, Ohio
Please send me a free copy of "A Businessman's Guide to the Molding of Plastics." The Booklet— not a salesman.
NAME
TITLE
(Attach this to your letterhead, please)



A few of the many types and sizes of closures made by the millions, at Owens-Illinois

SPECIALISTS in small plastics made in a BIG WAY!

OUR automatic molding machines produce hundreds of millions of plastic closures—all sizes, shapes and colors—every year!

These machines are ideal for efficient, economical, high-speed production of a great variety of small thermo-setting plastic parts and items.

If such items are important to your business, investigate our facilities.

OWENS-ILLINOIS GLASS COMPANY

TOLEDO 1, OHIO

Branches in All Principal Cities

Santay

SYMBOL OF PRECISION CRAFTSMANSHIP

Now... IT CAN BE SHOWN

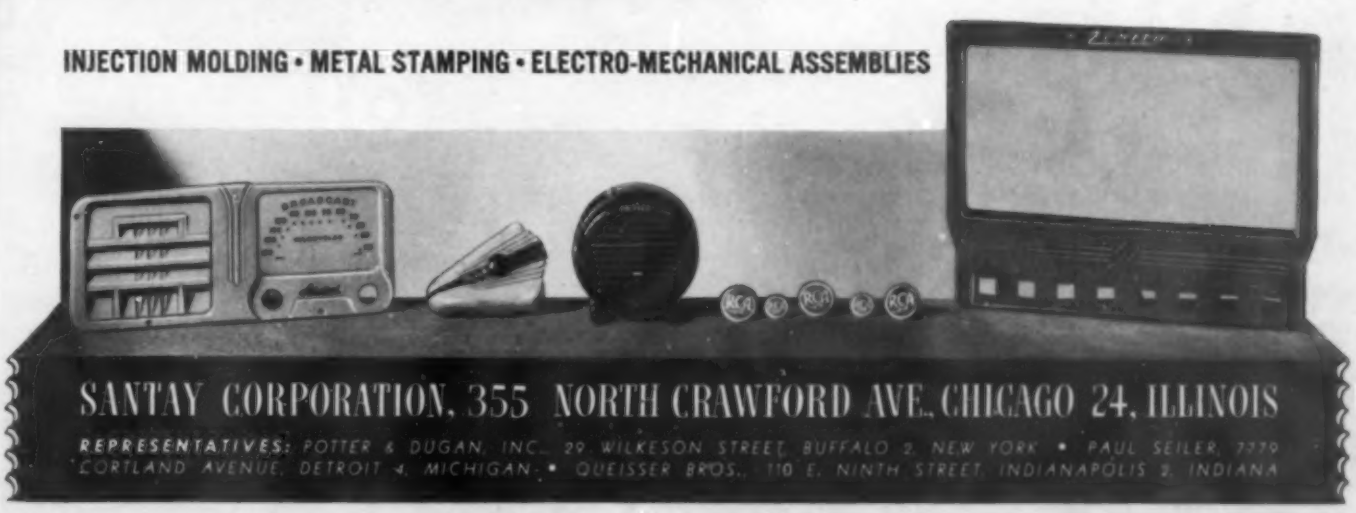
WHEN our previous advertisement was prepared, permission had not been granted to photograph the plastic parts used in producing the Jap-defeater V-T FUSE.. the secret weapon no bigger than a pint milk bottle. Now Santay Corporation is able to show the plastic housing which was one of vital component parts of this amazing fuse.

The extreme detail and precision craftsmanship employed in producing the mold are graphically indicated above. Only infinitesimal tolerances and perfect product uniformity could meet rigid naval specifications and inspection.

Here again Santay came to the front. Our tool and die makers were first to build this mold. And, our molding department was first to produce this intricate housing. This was, indeed, one of the most difficult plastic molding jobs connected with the V-T FUSE.

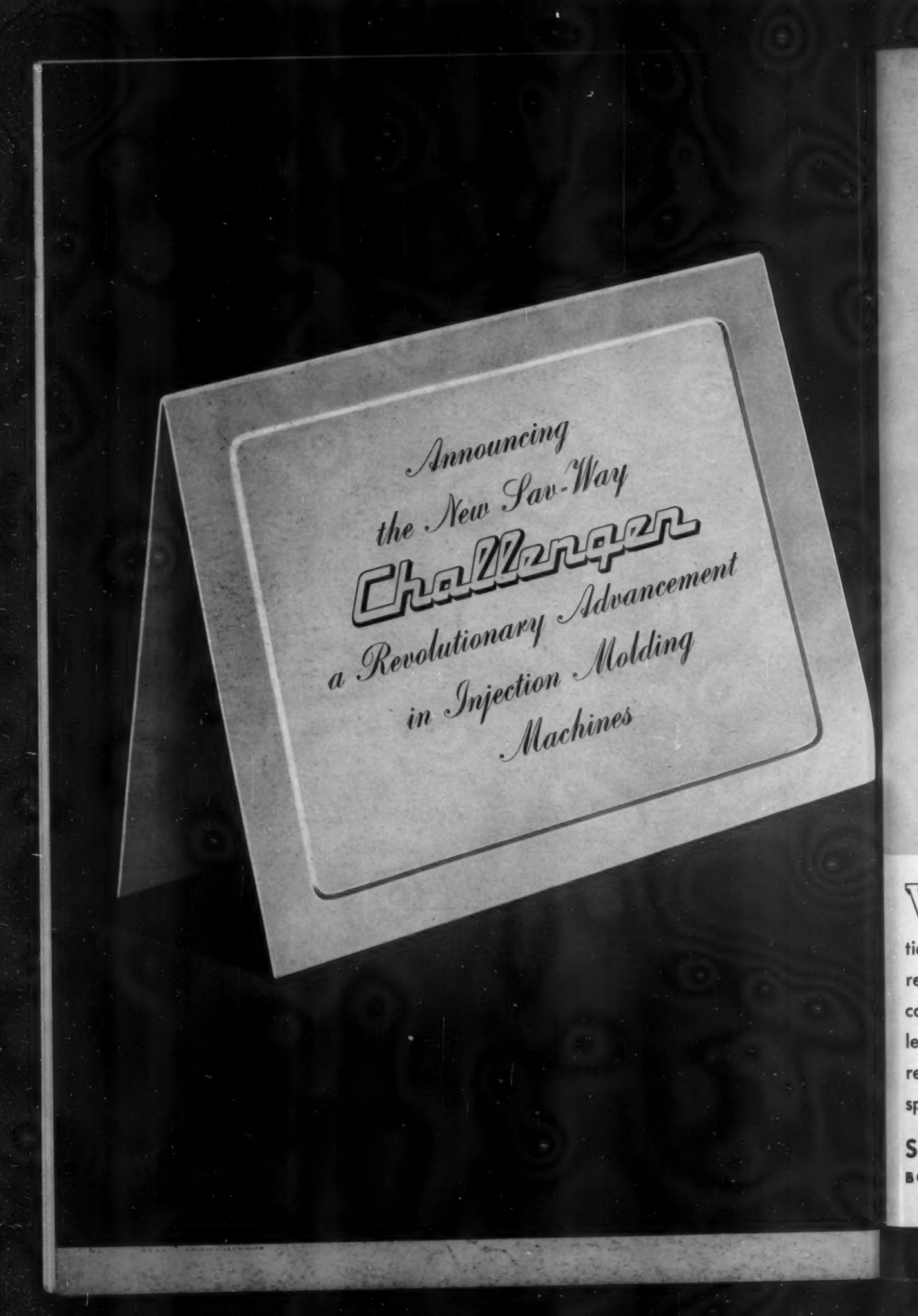
Precision craftsmanship and uniformity are always uppermost in the minds *and hearts* of our engineers as well as our tool and die makers. If a precision injection molding is indicated for your product, discuss it with our capable plastic engineers. There's no obligation.

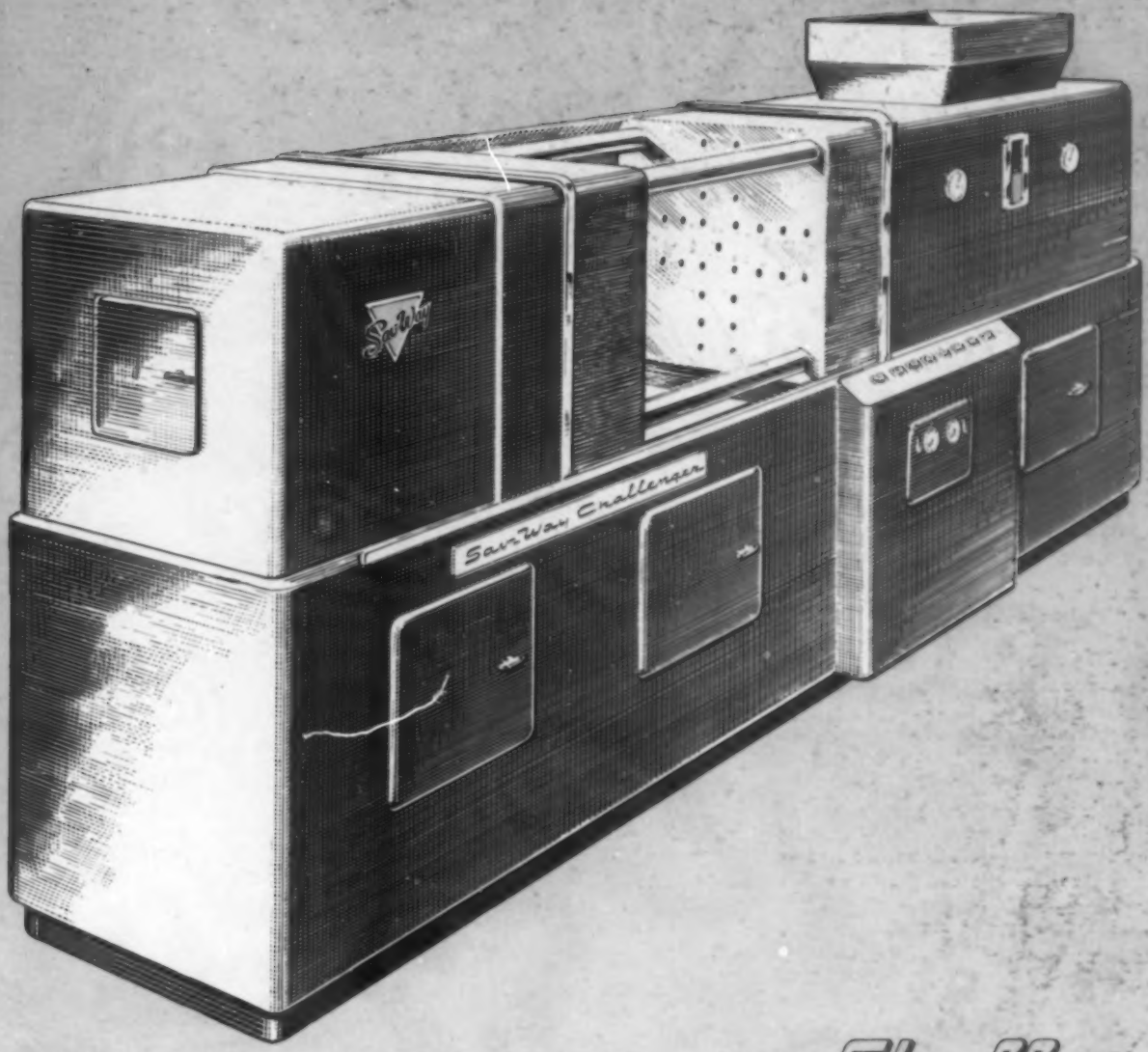
INJECTION MOLDING • METAL STAMPING • ELECTRO-MECHANICAL ASSEMBLIES



SANTAY CORPORATION, 355 NORTH CRAWFORD AVE., CHICAGO 24, ILLINOIS

REPRESENTATIVES: POTTER & DUGAN, INC., 29 WILKESON STREET, BUFFALO 2, NEW YORK • PAUL SEILER, 7379 CORTLAND AVENUE, DETROIT 4, MICHIGAN • QUEISSER BROS., 110 E. NINTH STREET, INDIANAPOLIS 2, INDIANA


Announcing
the New Sav-Way
Challenger
a Revolutionary Advancement
in Injection Molding
Machines



THE *Challenger*

CAPACITY 12 OUNCES

WITH the announcement of the "Challenger" 12-ounce injection molding machine, Sav-Way brings to the plastics industry the results of four years of intensive research and development—a new conception of plastics molding efficiency and economy. The "Challenger" is as advanced in engineering and production ability as it is refreshing in its brilliantly modern outward appearance. Complete specifications will be gladly furnished upon request.

Sav-Way

SAV-WAY INDUSTRIES

BOX 117, HARPER STATION • DETROIT 13, MICHIGAN

The Fabrication of Emerson Radio

CATALIN CABINETS IS PRESENTED AGAIN TO

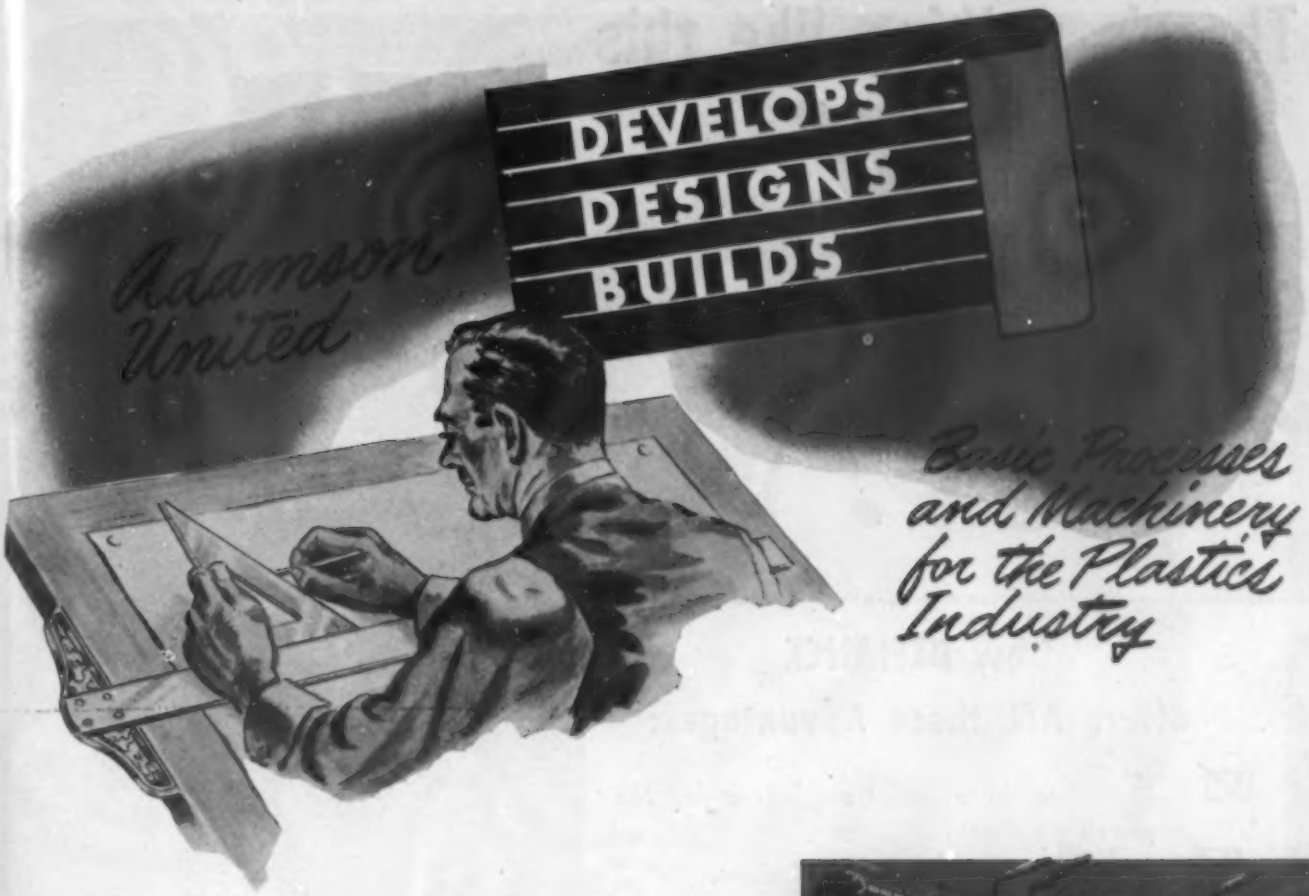
Plastic Turning Company

Before the war Emerson Radios, with cast phenolic cabinets fabricated by us, were creating a nation-wide sensation. Because our skill, experience and facilities contributed effectively to the production of a case of tasteful design and effective sales appeal, Emerson Radio has again turned to Plastic Turning Co.

In this current model, application by Emerson Radio of the stylish grill and knobs in moulded plastics further accentuates those qualities which make this fabricated cabinet a "thing of beauty".

If you too have a product requiring specialized skill in plastic fabrication, we ask that you take the first opportunity to consult us.

PLASTIC
Turning Co. Inc.
LEOMINSTER, MASS.



Not only new and better products, but new and more efficient processes and machines with which to manufacture them, must be developed to successfully meet today's growing competition in plastics.

To that end we offer you the benefits of our more than 50 years continuous research and experience in engineering and building basic processes and machinery for the plastics, rubber and allied industries.

Our engineers specialize in designing and building equipment for special or unusual requirements. Consult them freely. Their experience and abilities are at your service.

ADAMSON UNITED COMPANY

AKRON, OHIO

SUBSIDIARY OF UNITED ENGINEERING AND FOUNDRY COMPANY

Plants at: PITTSBURGH · VANDERGRIFT · NEW CASTLE · YOUNGSTOWN · CANTON

Affiliates: Davy and United Engineering Company, Ltd., Sheffield, England
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The World's Largest Designers and Makers of Rolls and Rolling Mill Equipment.

There's nothing like this

NEW Plastic Preform Press!

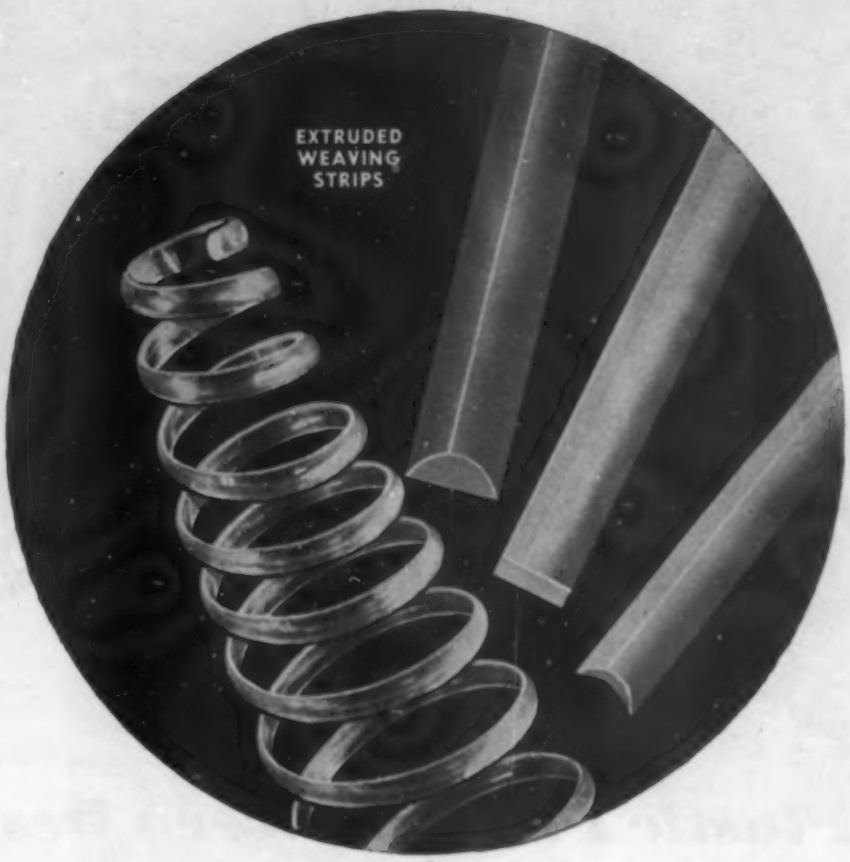
Only DEFIANCE offers ALL these Advantages:

- ☑ *Designed by plastics engineers for the plastics industry!*
- ☑ Wide range of shapes and sizes.
- ☑ High speed production.
- ☑ Greater uniformity of weight and density . . . cutting down molding rejects.
- ☑ Compact, modern design.
- ☑ Easy to clean . . . color changes can be made with minimum of cleaning time.
- ☑ Quick adjustment of density while operating.
- ☑ Quick adjustment of fill while machine is in operation.
- ☑ Can use multiple dies.
- ☑ Punches and dies can be quickly changed... machine complete with variable speed drive and clutch.
- ☑ Less material leakage assures greater economy.
- ☑ All lubricated parts enclosed and below die surface, thus eliminating preform spoilage due to oil contamination.
- ☑ Interchangeable parts. Precision made.

Write for latest bulletins.
Defiance Machine Works, Inc. • Defiance, Ohio.

DEFIANCE

BACKED BY 95 YEARS OF PRECISION MANUFACTURE



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Here's Once *when "Passing the Buck" paid!*

IN OUR SHOPS, we never thought much of people who passed the buck, until the boss did it. You see, we were using "stock" resins and getting plenty of production troubles and downtime. We had to "adjust" each shipment of those resins to our jobs. But, when the boss "passed the buck" to Interlake, it ended all that. Those Interlake specification resins were made to order for our jobs and they DO a sweet job.

USERS of Interlake resins RELY on Interlake to fit the resin to the job. That's because Interlake produces specification resins *functionally engineered* to the specific requirements and conditions of each application. Tests each resin on the job. Then stabilizes production of that resin for *continuous uniformity in performance.*

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Our experienced research men are glad to work with you on any resin problem, or to discuss the possible advantage of using resins in any operation or process. Write Interlake Chemical Corporation, Plastics Division, 1911 Union Commerce Building, Cleveland 14, Ohio.

Interlake Production-Stabilized Resins have been developed to precise requirements of coating, impregnating, and bonding . . .

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Another proving ground for plastics

One of the largest producers of phenolic resins uses this 200 ton Lake Erie Hydraulic Press to prove under actual manufacturing conditions the qualities of their molding compounds.

From it has come many of the advancements in product development and methods of molding the versatile materials which they supply to other manufacturers.

Realizing the great future of plastics Lake Erie engineers have made a thorough study of all types of fabricating methods. Already we have designed standard compression molding presses that can be adapted to your needs —or we can build presses to meet any special production methods you may require. Write for complete information.

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Maybe you won't see this happen at a track meet. But lightweights *can* have great strength. Look at KYS-ITE. Look, too, at the other unusual properties it offers—*that no other type of material combines!* The stiffer the competition the more important these advantages become:

GREAT STRENGTH WITH LIGHT WEIGHT
Preformed before curing, an even distribution of phenolic resin on interlocking fibres results in great tensile and compressive strength and with an impact strength up to 5 times that of ordinary plastics.

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Complicated pieces with projections and depressions, large or small shapes and sections—all these and more, too, are molded successfully in KYS-ITE.

KYS-ITE CAN "TAKE IT"
Unusually durable and resistant to abrasion, impervious to mild alkali and acid solutions.

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KYS-ITE's lustrous finish is highly durable; the color is an integral part of the material itself. A wipe and it's bright!

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KYS-ITE's dielectric properties make it invaluable where safety is a factor. Also a non-conductor of heat. Non-resonant and non-reverberating.

SORRY, BUT
The extensive demand for KYS-ITE won't allow us to take further specialty orders at the moment. The lifting of restrictions has improved this situation, however, and we hope it won't be long before we can say, "We're ready for you now."

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KYS-ITE articles indicating the range of items we mold to specifications and deliver complete, ready for use.

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IT

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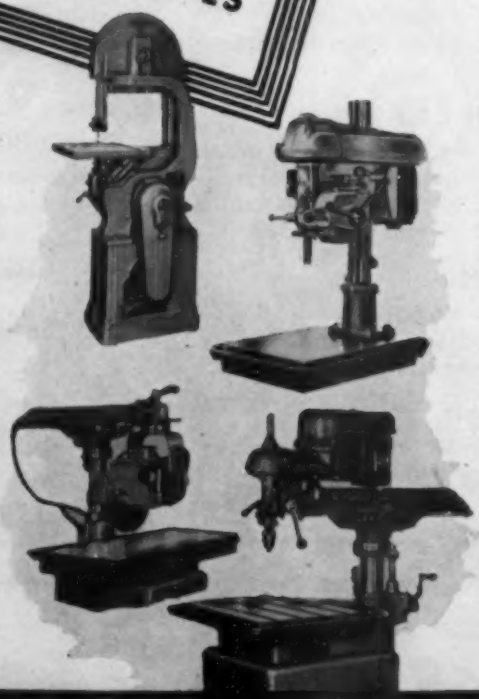

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● Right now, identical twins of molded plastics are rolling off our machines by the thousands, all earmarked for the military services, where uniformity is of prime importance.

In the postwar tomorrow, General Industries will once again be able to offer you the experience and equipment that will mold your plastic parts, efficiently and economically, the last piece as accurate as the first.

From blueprint to finished product, manufacture will be speeded by experienced engineers. For instance, we can offer slight changes in design that will improve the moldability of the product. Ingenious mold makers realize the utmost importance of accurately-placed inserts, close tolerances and finish to meet the most critical specifications. Skillful operators, working with modern equipment, will turn out any quantity of identical pieces that will work smoothly and efficiently in your finished products.

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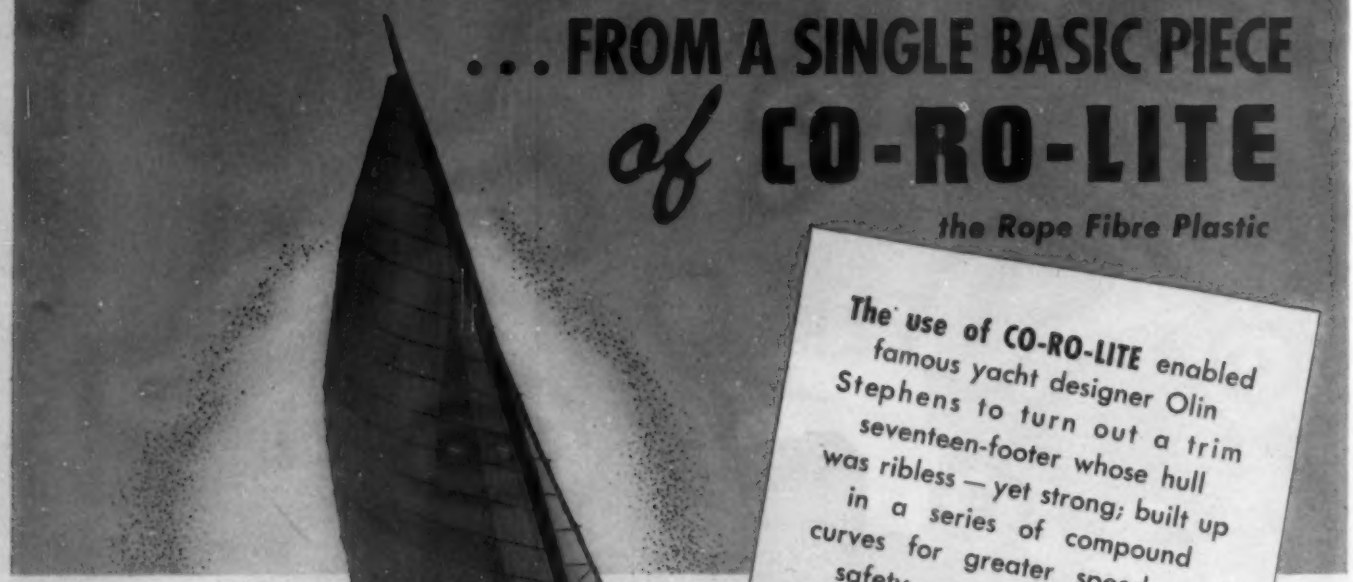
MOLDED PLASTICS

ARMY E NAVY

MOLDINGS AS LARGE AS THE HULL OF A BOAT ... FROM A SINGLE BASIC PIECE of CO-RO-LITE

the Rope Fibre Plastic



The use of CO-RO-LITE enabled famous yacht designer Olin Stephens to turn out a trim seventeen-footer whose hull was ribless — yet strong; built up in a series of compound curves for greater speed and safety — yet inexpensive to produce.

● There's real economy in the use of CO-RO-LITE—economy achieved through pre-forming, which eliminates lay-up—and through the speed of curing. A single piece of CO-RO-LITE is readily pre-formed and molded into compound curves, deep draws, angles, channels, and large shells.

CO-RO-LITE, the rope fibre plastic, is a ready-to-mold thermo-setting plastic compound. It is equally effective with fluid pressure, high pressure, flash, or transfer molds. Long, tough, interlocking rope fibres reenforce all sections of the molded unit, imparting great impact, flexural, compressive, and tensile strength in a range of densities comparable to wood.

In production, it is estimated that this aluminum mold and the large autoclave in the rear can produce these hulls in two hours each, plus twenty minutes for curing!

CO-RO-LITE: — Rope fibres impregnated with thermo-responsive resin: — Product and process patented — Patents No. 2,249,888 and No. 2,372,433 — other patents pending.

The latest handbook on CO-RO-LITE, the rope fibre plastic, is filled with the facts on which you must base your choice of plastic compounds. ASK FOR A FREE COPY TODAY.

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ALLIED PRODUCTS DIVISION

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HERE it is . . . the new Klearking Filter . . . a product of Empire Distributors of Chicago. It is easily attached to any faucet and, by means of a special filter disc, yields clear, sparkling water free from sediment and chlorine taste. And, thanks to CMPC Molded Plastics, the low production cost places the unit within the easy reach of everyone.

Molds were made and the plastics parts molded of a polystyrene material having extremely low moisture absorption, successfully resisting the effects of hot water at faucet temperatures. They are immune to rust and corrosion and consequently there is no danger of contamination. And the filter is available in a wide variety of attractive colors to harmonize with any kitchen color scheme . . . colors that will retain their sparkling beauty indefinitely.

This is another example of CMPC Complete Service . . . designing, mold-making, molding, and finishing . . . the ability and the facilities for handling any plastics molding job from the simplest to the most complex . . . a service that is backed by more than a quarter century of experience in plastics. And that's another reason why you'll find this a good place to bring your plastics molding problems.

Why not ask for the services of a CMPC Development Engineer? There's no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

1046 N. Kolmar Ave. Chicago 51, Illinois

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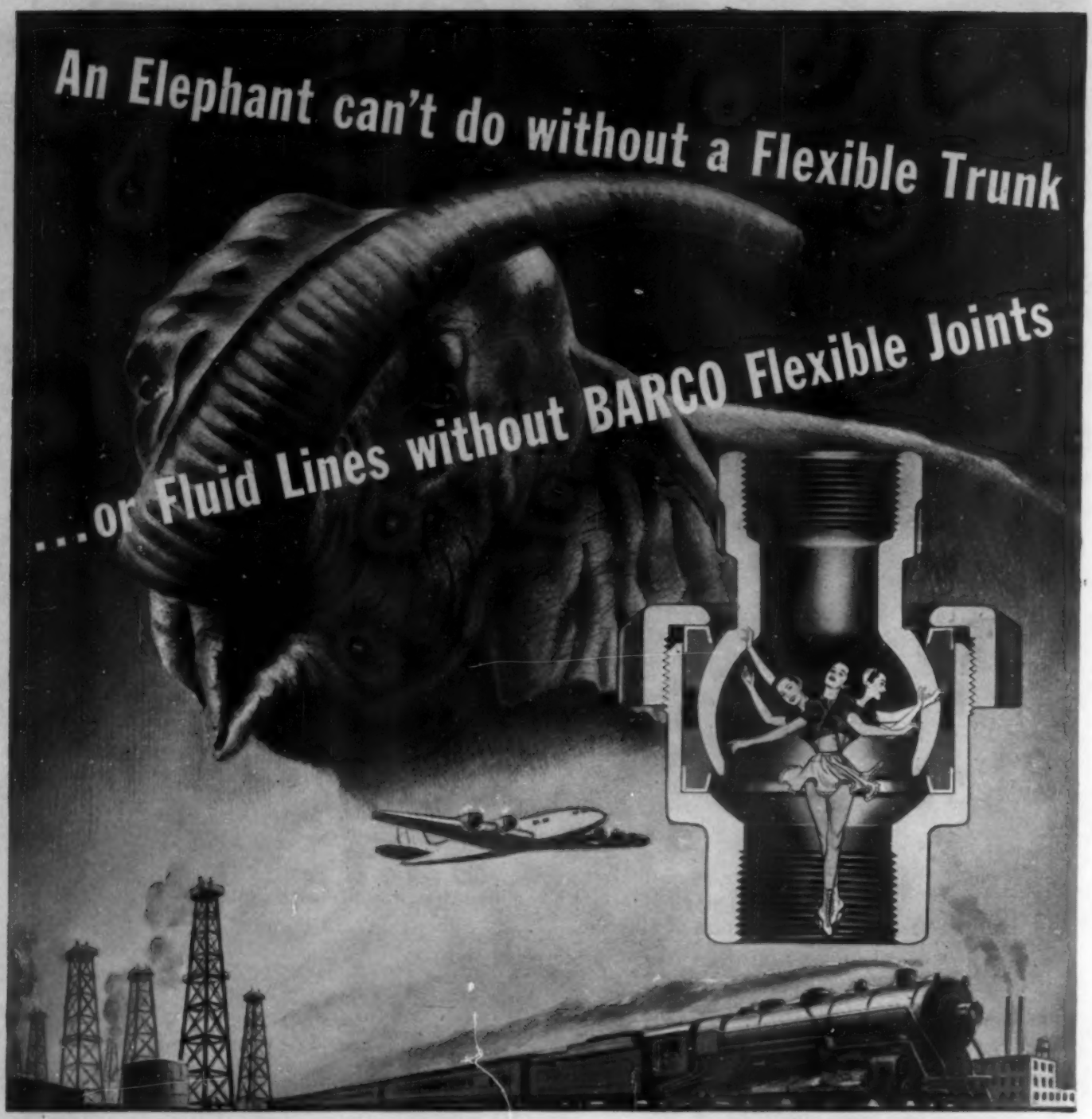
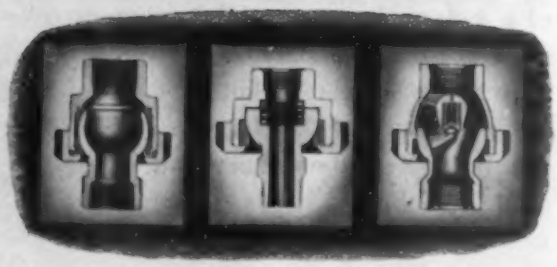
COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

An Elephant can't do without a Flexible Trunk

...or Fluid Lines without BARCO Flexible Joints



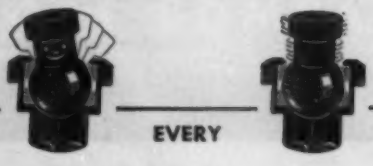
Nature provides flexibility in every living, moving thing. Because there is always movement—vibration, expansion, contraction—in any fluid-conveying system, Barco Flexible Joints are needed to provide responsive, compensating movement through every angle. For over 30 years they have been accepted as the standard for such protection against strain and shock. For complete engineering information, write to Barco Manufacturing Co., Not Inc., 1809 Winnemac Ave., Chicago 40, Illinois.



BARCO FLEXIBLE JOINTS

Not just a swivel joint...but a combination of a swivel and ball joint with rotary motion and responsive movement through every angle.

FREE ENTERPRISE—THE CORNERSTONE OF AMERICAN PROSPERITY



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Maintain Dial Accuracy With

GRAPHIC LAMICOID...

The Laminated Plastic

When an instrument must perform with a guaranteed accuracy of ½ of 1 per cent of the dial graduation over the entire scale, dimensional stability is an essential quality of the dial material.

The ability of Lamicoid to remain unaffected by continuous heat at 250° to 300° F. was one of the primary considerations in selecting this material for all Ashcroft duragauges manufactured by Manning, Maxwell & Moore, Inc.

Important too is the fact that Lamicoid is made with laminations of different colors. The dial shown for example, is black on both sides with a white core. Figures, names, etc., are a permanent part of the finished product. Markings can be engraved when a small quantity is required.

Different types of Lamicoid are available from Mica Insulator Company for practically every type of dial, chart, or sign application. These applications range from translucent, rear illuminated dials which show combinations of colors, to special writing graphic for recording information on charts with pencil. Pencil writing can be removed while the printed material remains on the chart itself.

Send your blueprints and specifications to our sales office or our fabricator and we shall be glad to suggest a Lamicoid material that meets your requirements.

MICA INSULATOR COMPANY

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SALES OFFICES: Boston: 285 Columbus Avenue • Chicago: 600 West Van Buren Street • Cincinnati: 3403 Hazelwood Avenue Cleveland: 1276 West 3rd Street • Detroit: Book Building • Houston: Bakoring, Inc., 1020 Houston Avenue • New York: 200 Varick Street

WEST COAST REPRESENTATIVES: Triangle Pacific Co. at Los Angeles: 340 Azusa St. • San Francisco: 1045 Bryant St.

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TULOX was on the job!

When the man up-front stopped one and the going was tough, welcome was the pain-easing, shock-preventing aid of the Syrette*—a small, single-shot hypodermic syringe filled with morphine tartrate.

Spotlessly clean and safe because the sterile needle on every one of the fifty million that E. R. Squibb & Sons sent to our fighters was protected against germs and contamination by TULOX.

TULOX TT Tubing was chosen by the cap fabricators because it is strain-free and made to extremely close tolerance, TULOX features that have made it the answer to so many problems in war and industry.

Versatility is also typical of TULOX. On land, at sea, in the air—and throughout industry—it fills an amazing multiplicity of needs.

TULOX TT Tubing is *now* available for immediate delivery from warehouse stock in random 12 foot lengths, clear transparent only.

39 sizes are available in diameters from 1/8" O. D. to 2" O. D. Other sizes and colors can be made to special order only.

Send for end-use photo-folder and current data sheet.

*Reg. U.S. Pat. Off.

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NEW CANAAN AVENUE, NORWALK, CONNECTICUT, U.S.A.

IN CANADA: DUPLATE CANADA, LTD., PLASTIC DIVISION, OSHAWA, ONTARIO

FROM LABORATORY MIDGET TO PRODUCTION GIANT—

F/B CALENDER DESIGN FITS THE JOB

Here is an illustration of the wide range of sizes of Farrel-Birmingham Rubber and Plastics Calenders. From the 8″x16″ laboratory size to the huge 32″x70″ production machine, the physical proportions, materials, type of construction, lubricating systems, gearing, special operating features—in fact, every vital detail is designed to fit the job the calender is built to do. Here, in part, is how this principle is carried out in the units shown:

THE 32″x70″ FOUR-ROLL PRODUCTION SIZE

Built for close control of gauge in double coating and multi-pass sheeting of rubber and plastics products, this calender has individual motors for each screw of the top, bottom and side rolls. This means that a screw can be operated independently to adjust one end of a roll, but can also be synchronized with the one at the other end for parallel adjustment.

Chilled iron rolls, carefully ground on the bodies and chamber-bored for steam circulation, are carried in full bronze-lined journal boxes. The housings and other parts are proportioned in size and weight to the large rolls, which offer more than three times the resistance to deflection ordinarily provided. Lubricating systems which provide a constant supply of lubricant to all moving parts contribute to higher operating efficiency, reduced maintenance and longer life.

THE 8″x16″ FOUR-ROLL LABORATORY SIZE

Designed for experimentation and for small production of rubber and plastics stocks, this unit is entirely self-contained, the drive being enclosed inside the base. Journal boxes are flood-lubricated, with circulating pump, oil cooler and oil sump tank mounted in the base. An adjustable speed motor provides the optimum operating speed for any individual stock.

Write for further information regarding calenders or any of the other equipment listed on this page.

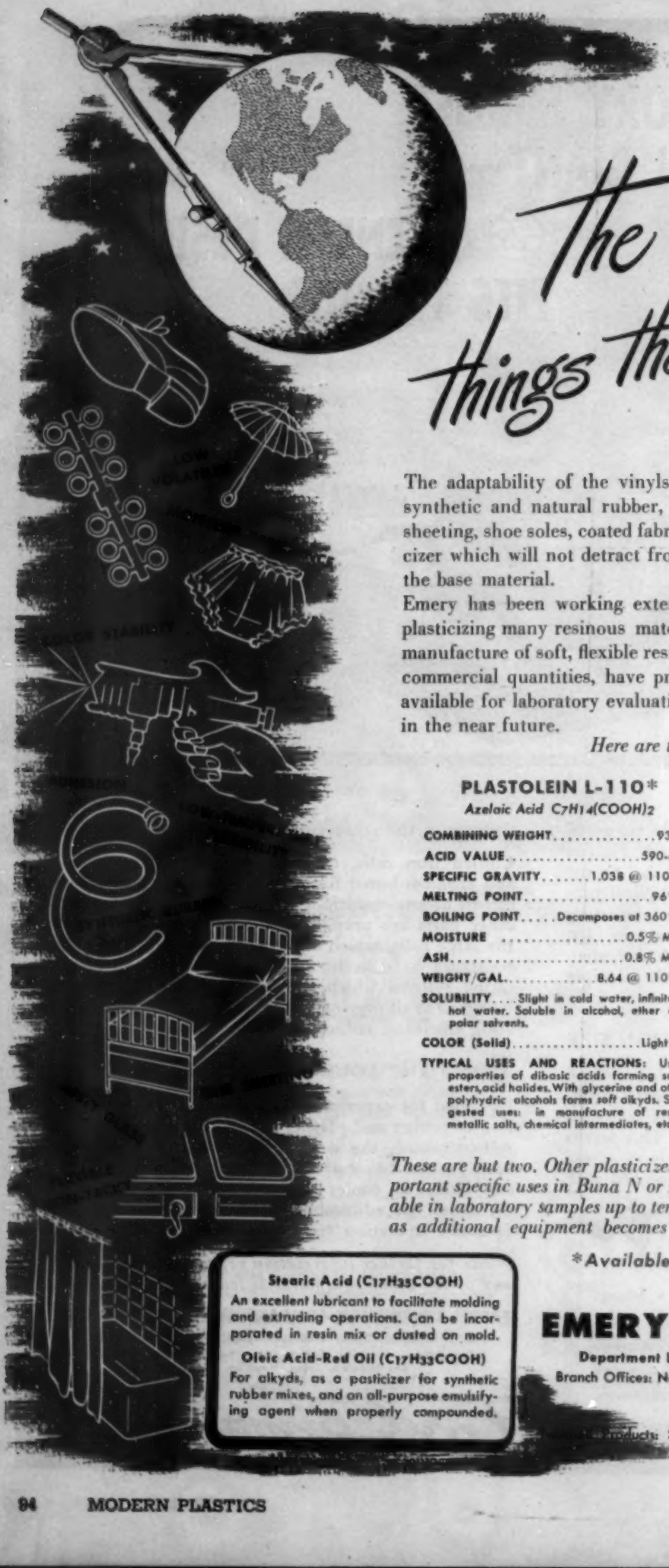
F-B PRODUCTION UNITS

Banbury Mixers • Plasticators • Pelletizers • Mixing, Grinding, Warming and Sheeting Mills • Bale Cutters Tubing Machines • Refiners • Crackers • Washers Calenders • Hose Machines • Hydraulic Presses • and other equipment for processing rubber and plastic materials.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte.

Farrel-Birmingham



The Shape of things that Have Come

The adaptability of the vinyls, polymers and copolymers, nitrocellulose, synthetic and natural rubber, to many products—surface coatings, crib sheeting, shoe soles, coated fabrics, to mention but a few—requires a plasticizer which will not detract from the important "wear" characteristics of the base material.

Emery has been working extensively on such products, one group for plasticizing many resinous materials, another to be used directly in the manufacture of soft, flexible resins. Many of these, now available in limited commercial quantities, have proved themselves in practical use. Others, available for laboratory evaluation now, will be in commercial production in the near future.

Here are two typical examples:

PLASTOLEIN L-110*

Azelaic Acid $C_7H_{14}(COOH)_2$

COMBINING WEIGHT.....93-97
ACID VALUE.....590-602
SPECIFIC GRAVITY.....1.038 @ 110° F.
MELTING POINT.....96° C.
BOILING POINT.....Decomposes at 360° C.
MOISTURE.....0.5% Max.
ASH.....0.8% Max.
WEIGHT/GAL.....8.64 @ 110° F.
SOLUBILITY....Slight in cold water, infinite in hot water. Soluble in alcohol, ether and polar solvents.
COLOR (Solid).....Light tan
TYPICAL USES AND REACTIONS: Usual properties of dibasic acids forming salts, esters, acid halides. With glycerine and other polyhydric alcohols forms soft alkyds. Suggested uses: in manufacture of resins, metallic salts, chemical intermediates, etc.

PLASTOLEIN X-55*

Diethylene Glycol Dipelargonate

MOLECULAR WEIGHT.....362 (average)
ACID No......2.0 Mgs. KOH
SPECIFIC GRAVITY 0.9690 15.5° C/15.5° C.
FLASH POINT.....210° C.
FIRE POINT.....234° C.
FREEZING POINT.....—15° C.
HYDROLYSIS (Boiling Water—2 Hrs.)....0.6 increase in Acid Number
WEIGHT/GAL.....8.08 @ 15.5° C.
AVERAGE BOILING POINT 232° C at 5 mm
COLOR.....Yellowish
TYPICAL USES AND REACTIONS....Compatible with nitrocellulose, most of the vinyls, ethyl cellulose, methyl methacrylate, and cellulose acetate-butyrate. Soluble in most common solvents. Recommended as a general plasticizer, particularly for good low-temperature plasticity and where flexibility is to be retained over a wide range of temperatures, without tackiness developing.

These are but two. Other plasticizers which have been evaluated for several important specific uses in Buna N or Butyl Rubber mixes, for example, are available in laboratory samples up to ten gallons. Larger scale production will begin as additional equipment becomes available. Write for further information.

***Available in limited commercial quantities.**

Stearic Acid ($C_{17}H_{35}COOH$)
An excellent lubricant to facilitate molding and extruding operations. Can be incorporated in resin mix or dusted on mold.

Oleic Acid-Red Oil ($C_{17}H_{33}COOH$)
For alkyds, as a pasticizer for synthetic rubber mixes, and an all-purpose emulsifying agent when properly compounded.

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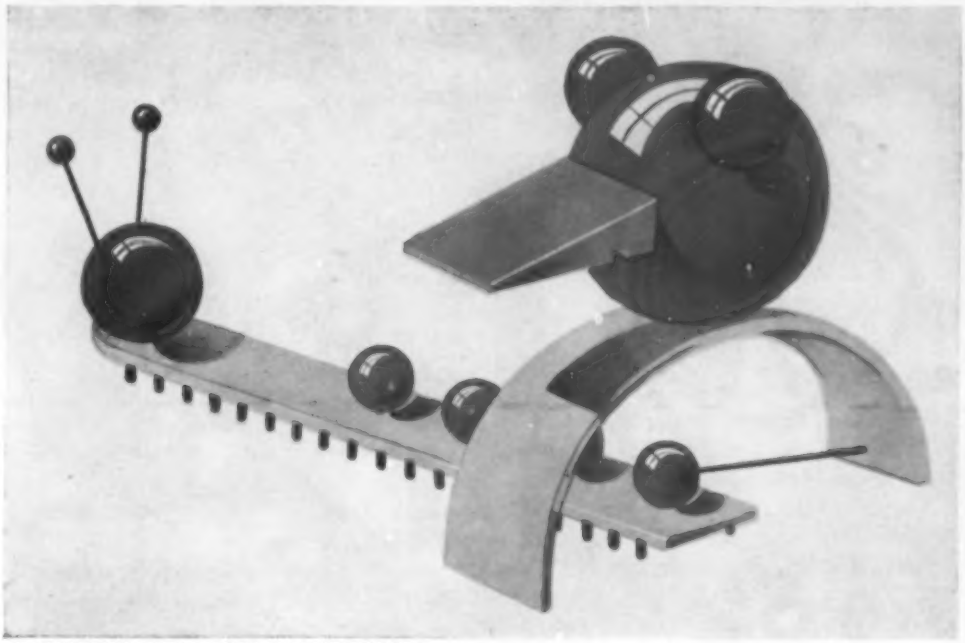
PLASTICIZERS

Products: Stearic, Oleic, Vegetable and Fish Oil Fatty Acids

MODERN PLASTICS

DECEMBER 1945 VOLUME 23 NUMBER 4



1—*Molded plastic and resin-bonded paper laminates lend themselves to imaginative toys of type depicted in this drawing. There is almost no limit on the way in which the several parts can be combined or upon the colors in which they can be produced*

COLOR RENDERINGS, FIGS. 1, 2, 3 AND 4 BY PRODUCT DESIGNERS

TIME TO PLAY

Christmas of 1945. A Christmas of peace. A Christmas of laughter and fun, of tinsled trees and bright-colored gifts—lots and lots of each. For it is once again the time to play.

A good many new daddies will be seeing their youngsters for the first time; the others will be trying to recognize in bashful toddlers the babies they glimpsed so briefly a year or so ago. And in the joy and bewilderment of this reunion, toys will play an important role, for with these bright and appealing weapons the barriers of strangeness fade quickly away.

THE SPIRIT of this Christmas of 1945 is one of peace; but the gifts which are our outward expression of the season still bear the earmarks of war. To the toy industry, in particular, peace came too late in the year to permit the introduction of new lines. There are exceptions, of course. But, on the whole, the toy counters hold the same merchandise featured throughout the year—since the year 1942 in many instances.

It will be January or February of 1946, perhaps even March when the toy fair is held, before a major portion of the new designs and the new ideas make their appearance. First there is the pricing problem to be settled.

According to the best available figures, the toy industry does an average annual volume of business estimated at $110,000,000 (wholesale). And this figure it maintained—both before and during the war. When materials became scarce with the increased demands of war and essential industries, it was but natural that toy manufacturers diverted a goodly portion of the raw materials still available to them to the higher priced lines.

In this way, dispite the fact that their prices were frozen at 1942 levels, the old-line manufacturers were able to hold their own with new toy producers who were permitted to price their goods on the basis of current costs.

And now the price and production picture is expected to double back on itself. As raw materials become more readily available, greater quantities of inexpensive toys will appear on the market. This will mean an adjustment in the price of some of the goods now on the counters; the end of other lines. Again, there will be no modification in the selling price.

An expansion in toy volume

But this reversal does not necessarily mean that the toy industry is going to cling to the $110,000,000 annual volume figure. There are indications that while unit prices will come down, the increased volume of production will leave the industry with a greater annual dollar volume. Just what this

2 and 3—It might be a bird, a dog, a horse. That is the charm of these toy designs which are well adapted to plastics. The bright colors are a sure eye catcher

2

3

gain will amount to is still a moot question; but its future existence is practically assured.

There is, first, a tremendous pent-up demand for toys of all descriptions. The baby, the toddler, the school child, all have felt the shortage of playthings. Sometimes it was an overall want, the absence of any suitable toy; again, it was the longing for a particular plaything, loved before the war.

Add to this the unusually high birth rate during the past few years, and the predicted increase in the toy industry is easily credited. It has been estimated that about 9 million children have been born in the United States since Pearl Harbor—the largest number of births in a similar period in the history of the country. The startling increase of births will have its effect not only in 1946 but for a number of years to come, and not on the toy industry alone.

Another factor in the anticipated expansion of the toy industry is an increased awareness of the value of toys in providing constructive outlets for young energies. A toy is now recognized as much more than a means of amusement. A wise choice of playthings can be an important factor in developing capabilities and directing interests into constructive channels. And so, their purchase is regarded as much a necessity as a pleasure.

Plastics in the toy field

The part that plastics will play in the playthings of tomorrow depends, to a large extent, on how it can meet the competition of other traditional toy materials. With plastics, metal and wood, all in free supply it will be a question of which material can best meet the requirements of a particular toy—not always at the cheapest price, but rather at a price that is reasonable in view of the nature of the plaything. Here is where good engineering will come into play; first in the selection of the most suitable material, then in the correct use of that material.

At the outset, plastics have a number of qualifications, not possessed in the same combinations by other materials, that make them particularly suited for use in toys. Color is one, and a wide variety of forms, another. Then, too, plastics can be molded to almost any desired contour by mass production methods—a factor of considerable importance in the toy industry. And they are light in weight.

Dividing the field in two

All four of these factors have significance for both of the broad fields into which the toy industry seems to divide itself. The critical point which marks the end of one toy régime and the beginning of the other is the date when a child starts to associate with others of his own age. Up until that time youngsters want "do-with" playthings, but ones that are not too closely identified with objects of the everyday world.

Pre-nursery children have tremendous imaginations of which they are totally unaware. Given a cardboard box for a boat they truly sail the seas—so much so that they are fearful of leaving their box-boats when summoned abruptly from play, convinced as they are that water is lapping at the sides of their boats. Their scooters are, by turns, horses, steam engines, airplanes, automobiles.

This is also the period during which youngsters are learning to make use of all their senses. Kicking, crawling, feeling and just seeing are great adventures. And since all this activity is so new, the execution is clumsy which means that colors must be bright, objects large, operations simple.

And then comes the change which, while it dates from the moment a child begins to commune with others of his own age, is partly occasioned by improved control over his body. The rest of the explanation lies in a feeling of smallness in a gigantic world. By having possessions which are exactly like

those of grown-ups, a youngster achieves an identity with these oldsters who seem so secure. Thus, the toy airplanes, automobiles, trains, dolls, doll furniture that must duplicate the real objects to the last detail.

For the pre-nursery child

Abstractions—It would be hard to find better examples of toys that give full rein to a toddler's imagination than the designs reproduced in color in Figs. 1, 2 and 3 of this article. All three of these creations were drawn up with molded plastic parts and sections of resin-bonded laminated paper in mind. What other materials would provide the variety of shapes called for in these sketches and the bright clear colors? Both metal and wood could, perhaps, be formed to the requisite dimensions, but the color would be of the surface only. And, should metal be used, the weight would make the toy unsuitable for the very age group for which it was intended.

As the three toy abstractions are presented on these pages they have a kinship with the birds. The design of Fig. 1 is reminiscent of a thrush; that in Fig. 2 of a robin. But had the artist worked on them a day later he might well have made one resemble a dog, another a man and the third a cat. This latitude is possible because the designer envisioned the toys being constructed of many separate parts. Thus, there is almost no end to the ways in which the various colored balls, wedges and curved strips can be combined. Here, indeed, a child has ample opportunity to apply his imagination without being in any way inhibited.

Blocks—Perhaps the oldest toy abstractions are the building blocks. Whether by intent or not, these toys are well designed to give free rein to a child's imagination. Stacked one way they form a castle, built up another way they are a fortress, boat or barnyard.

Blocks have always had an appeal for the parents, too. During the first few years of a child's life, while he is learning to manage his body and acquaint himself with everyday surroundings, he is constantly on the move, constantly trying things out. Anything that will keep him occupied while mother is busy about the house is welcomed.

And this the building blocks have always been able to do. The original wooden toys, however, suffered from the fact that the bright-colored finish quickly disappeared. Children have a passion for gnawing and sucking, treatment which no paint seemed able to withstand. Plastics were the perfect answer because the color is a part of the material and cannot come off. In addition, plastic toys are easy to keep clean and sanitary, and are light in weight.

Figures 7 and 8 are typical of the work done by the plastics industry in this field. In both cases the material is cellulose acetate. The first, the fully enclosed blocks, are injection molded in two parts. The advantage of this construction is that the blocks can be made up with a two-color effect, the pink of the top side contrasting with the blue shade used for the rest of the toy.

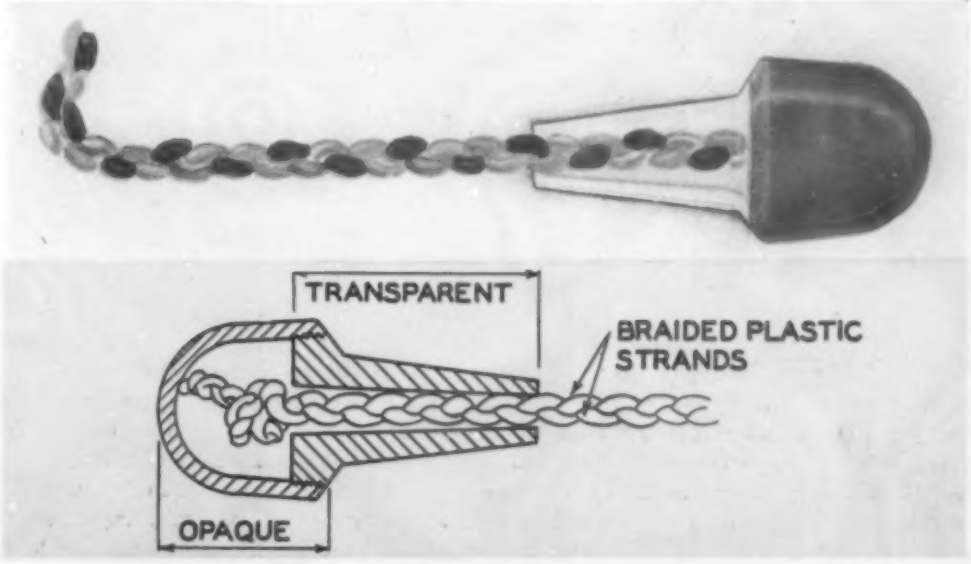
The injection-molded nesting blocks in Fig. 8 are much like those in Fig. 7 except that they are without the sixth side. Not only are these toys well engineered but they show a knowledge of the way children react. On the practical side, they are ribbed so that the most vigorous chewer will have difficulty breaking through the sides. This strength is important in baby toys since these playthings are often thrown from crib and carriage and knocked against hard surfaces As for versatility in use, the open-sided construction gives additional play value, allowing the toys to be nested. The figures engraved on the sides are set in deep enough so that the blocks can serve as sand-pile molds. Then, like all plastic playthings of this type, they can be floated in the bath.

The same designer who developed the skipping rope sketched in Fig. 4 has suggested transparent blocks as attention getters. In one instance a solid cube is envisioned with figures and letters embossed on the sides with heated dies. Again the block, which can be either square or triangular, is designed so that it can be molded in two sections. To give variety, small colorful bits of material are sealed inside these toys.

Rattles and teething rings—With the elimination of Germany and Japan as a source of supply for blown toys as a result of the war, production of cellulose nitrate playthings has enjoyed a boom in this country. It was this plastic from which the earliest toys were made, and they have always been a popular item in the field.

The foreign market, incidentally, has not been a serious factor in the toy industry since before World War I. At that time only about 20 to 25 cents out of every dollar spent in this country for toys went to a foreign nation. This figure had dropped to 5 cents by 1941 and the expectation is that the United States will continue to produce all but, say, 5 percent or less of its own playthings.

Cellulose nitrate, however, is just one of the many plastics that have been used in rattles and teethers. All the play-



4—Plastic materials were in the mind of the designer when he developed this skipping rope design. The bright colors of the braided plastic strands are not lost even in the handle which is envisioned as being formed of transparent material with an opaque top

5

PHOTO, COURTESY CATALIN CORP.

***5**—Cellulose acetate and casein are combined in these four colorful, lightweight rattles and teething rings. **6**—Cast phenolic is another favorite with manufacturers of babies' playthings. **7**—Blocks have always been most popular with nursery children. In the case of these particular blocks, the two-part construction is used to give the toys a two-color effect*

things in Fig. 5, for example, are assembled from cellulose acetate and casein parts. The doll-face rattle uses a cellulose acetate transparent ring and spacer beads, and disks of casein. In much the same way the spiral rattle is made up of an acetate tube, spiral, end caps, rings and spacer beads, and casein disks. Cast phenolic has also proved its popularity in this field and is represented in this article by the joined doll and flexible rings shown in Fig. 6.

It would be hard to say whether it is the bright colors of these plastics, their amenability to washing and sterilization or the ease and speed with which they can be processed that is mostly responsible for the materials' popularity. Whatever the cause, these baby things have done much to sell mother and dad on plastic toys for the older children and have left them susceptible to the idea of using these materials in yet more and different playthings.

7

It has been suggested, for example, that the much-beloved stuffed doll and animal be covered with vinyl material. These toys, perhaps more than any other, must endure the most exacting conditions of use. It is not at all out of the way for a child to refuse to dress, wash, eat or sleep until its stuffed dog or cat is clutched in one hand. The plaything must go into the bath with the youngster, sample the breakfast porridge, be dragged along to the sand pile.

The only answer is constant washing and scrubbing of the covering of these soft dolls, an answer that is extremely hard on the printed fabrics. Yet this is the type of treatment that vinyl materials are well able to support. They would, moreover, maintain their original colors and not fade away to a shadowy tint.

An approach to this use of plastic material is the vinyl bubble ball that has just appeared on the market. While it is designed for the second age group into which toys seem to fall, it suggests how well vinyl materials adapt themselves to the needs of the toy industry.

When children meet

It is at the time, when mother's apron strings loosen a bit to allow association with other children, that the forming properties of plastics, which made them so ideal for imaginative toys, are turned to the production of detail. One would little think that youngsters would notice the exact placement of machine guns on miniature warplanes or the curve of the fuselage around the wheels—but they do. In fact, such notice on the part of a child caused one manufacturer of toy planes to hold up production until the design had been corrected.

This mania for exactitude on the part of children, boys and girls alike, has proved to be a boon to plastics. Neither in metal nor in wood can minute details be brought out so well as in molded plastic toys. *(Please turn to next page)*

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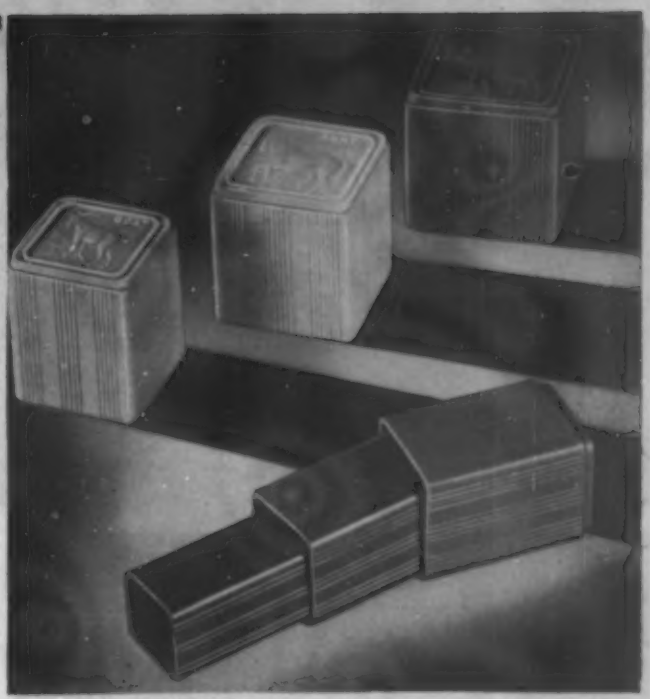

PHOTO, COURTESY CELANESE PLASTICS CORP.

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8—Nested blocks of cellulose acetate are a variation of the standard block construction. 9—Sturdiness is combined with good surface texture in these molded cellulose acetate dolls. 10—Children's playhouse furniture fabricated of acrylic sheet has the streamlined appearance that characterizes the modernistic furniture of grown-ups

12

13

11

Miniature boats and planes—The desire to imitate and the desire for movement, which is a second characteristic of children of this age, have combined to make these miniatures among the most popular of toys. Figures 11, 13 and 17 show a few of the models, all molded of cellulose acetate.

The war theme still exists as shown by the jeep in Fig. 11 and the warplanes in Fig. 17, but there are civilian models in Fig. 13 and a helicopter in Fig. 11 to give an indication of what is ahead. This latter item is particularly intriguing because of the way the wheels and propeller blades are connected by a set of gears which causes the propeller to turn at every revolution of the wheels.

Instead of molding a toy car one manufacturer has experimented with the idea of blow-molding sheets of methyl methacrylate. Shown in Fig. 14, this model is sprayed on the inside with red paint after forming.

Doll Playthings—There is no need for the girls to envy their brothers, for the plastics industry has developed a wide range of playthings that are strictly feminine. There are dolls, doll furniture, toy tea sets, tableware, etc.

Only a start had been made in the molding of dolls when the war came, but the reactions of the children left nothing to be desired. Much like the toys of the younger group, dolls live hazardous lives. When they are good they must endure overvigorous loving; when bad, they must be prepared to withstand all manner of shaking, spanking and beating.

Against such handling, injection-molded cellulose acetate dolls offer excellent protection. They are practically unbreakable and vegetable dyes are used to give proper color.

It is expected that there will be considerable activity in this section of the toy industry in the days to come. Considering that estimates allot 20 to 22 million dollars out of the industry's annual average volume of 110 million dollars to dolls, this interest is to be expected. The demand seems to be for a toy with a texture reminiscent of a real baby. This is where the plastics industry's many compounds, forms and textures should prove of outstanding benefit.

Playhouse furniture—To give these precious dolls a place to live, several manufacturers have produced tiny, clear acrylic tables, chairs, sofas and lamps. The non-splintering qualities of this material was one factor in its adoption for this toy.

Slightly bigger but still used in playing house is the toy telephone shown in Fig. 12. Molded of a phenolic material this two-color unit is an almost perfect example of how well plastic can be used by the toy industry to duplicate the details found in the full-scale parts.

Skipping ropes—A young girl and her skipping rope are familiar sights throughout the world. A new approach to the designing of these playthings is presented in Fig. 4. The transparent plastic handle with its colorful opaque is an invitation to any child. And to add to the brightness, the rope itself is braided from multi-colored strands.

Hobbying—Somewhere along the way to growing up, youngsters conceive a desire to duplicate the possessions of their elders—but to make the duplicates themselves. A few trials and errors, and a hobbyist is born. Several companies are distributing kits containing either transparent or opaque blocks, strips and just plain pieces of plastics.

Then there is the hobbyist who prefers to buy his materials rather than build them. For him are constructed such things as a resin-bonded wood and plastic airplane shown in Fig. 15. The laminated body of the plane, the wooden wings, the metal landing gear and the rubber wheels are so designed that they can easily be assembled with screws.

Musical instruments—A bugle, a mouth organ, a drum and an ocarina are examples of the use that has and will be made of plastics in the musical field. The tone of these molded and fabricated instruments has received high praise, with the

PHOTO, COURTESY AERO PLASTICS CO.

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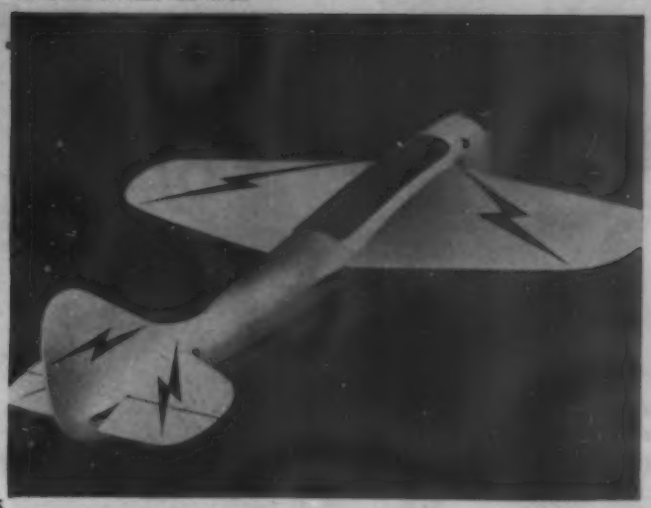

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17

11—This year toys show the influence of both war and peace as in this cellulose acetate helicopter and jeep. 12—Phenolics are used to duplicate in this plaything the lines of the commercial instrument. 13—The manufacturer of these cellulose acetate cars has cut his package to the shape of a service station. 14—Methyl methacrylate blown sheet forms this model car. 15—For the hobbyist, there are phenolic resin bonded plywood planes. 16—Plastic, in this case phenolic material, is a favorite with manufacturers of musical instruments. 17—Miniature cellulose acetate planes continue in great demand with both the pre-school and school child

critics hard put to find a point where the molded units differed from instruments made from traditional materials. While the ocarinas in Fig. 16 were molded of jet-black phenolic, other materials including acetates, butyrates and acrylics have proved satisfactory in various other musical instruments.

Highlighting the field

There are hundreds of other toys which have been produced of plastics, but the ones mentioned and pictured on these seven pages serve to indicate the wide variety of playthings that can be made of these materials. Almost every plastic has found some niche in the toy field, and one which should grow in importance as these materials prove themselves in unrestricted competition with metals, rubber and wood.

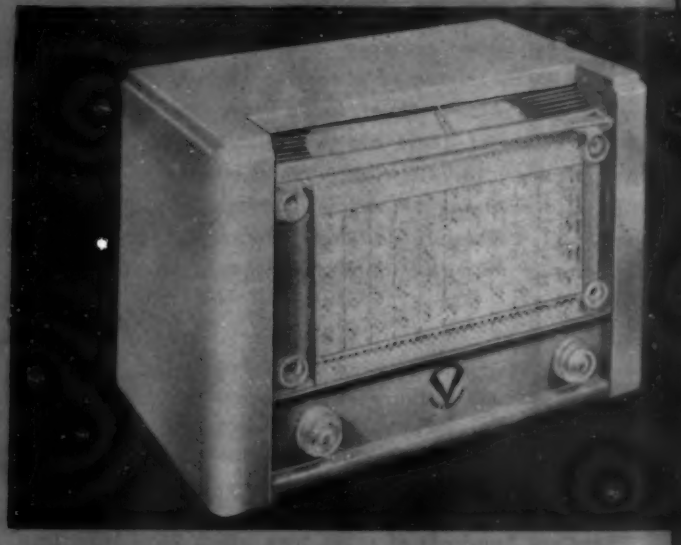
Acknowledgment

We wish to thank the plastics materials manufacturers and the toy manufacturers for their cooperation in the gathering of material for this article. Acknowledgment is also given to the Toy Mfgs. of U.S.A., Inc., Playthings Magazine and the following plastic processors, producers of some of the toys used as illustrative material: Weston Plastics, Mattel Creations, Dillon-Beck Mfg. Co., Stack Plastics, Aero Plastic Co., Waterbury Companies, Inc., Extruded Plastics, Synthetic Plastics Co., American Plastics Corp., Ideal Plastics Corp., Acme Plastics Mfg. Co. Special mention should be made of the art renderings shown in Figs. 1, 2, 3 and 4 which are the work of Product Designers. The plastic materials used in the production of the toys pictured in the article include Catalin, Fibestos, Tenite, Plastacele, Lumarith, Nixonite, Plexiglas, Lucite, Bakelite, and Durez. Thanks are also due to Tykie Toy, Plastic Playthings, Inc., Airtronics Development Corp., Halson Products, Inc. and L. C Bland.

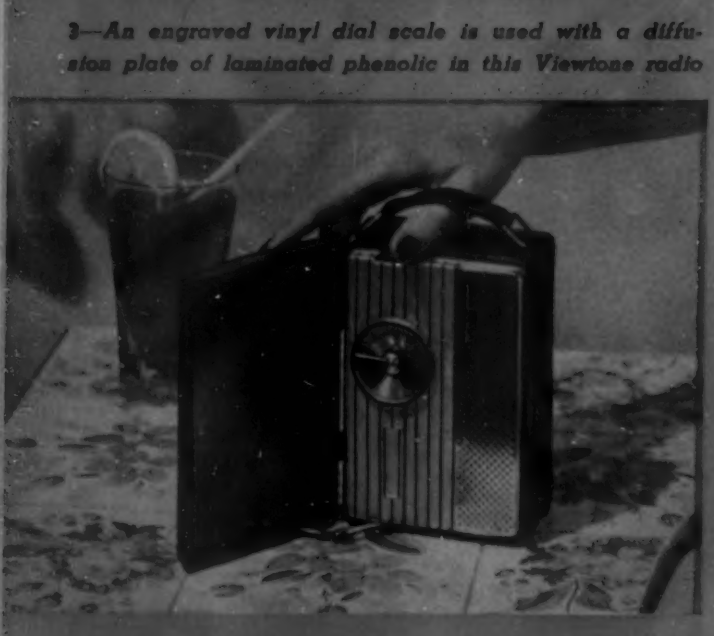
1—A cast phenolic housing and a compression molded acrylic grille are features of Emerson's table model

2—For the grille of this phonoradio, Emerson uses a perforated phenolic resin bonded sandwich construction

3—An engraved vinyl dial scale is used with a diffusion plate of laminated phenolic in this Viewtone radio



4—This second Viewtone radio has a cast phenolic case; a sound grille and knobs molded of methyl methacrylate



6—R.C.A. Victor's pocket radio, one-third smaller than the prewar unit, is housed in a case of polystyrene

7—Like many other new table radios, this R.C.A. Victor model has a slanting top strip dial for easy reading

TUNING IN ON 1946 RADIOS

THANKS in no small degree to improvements in cabinet and mold design, radio manufacturers have led American industry in the presentation of postwar models, largely small units in plastic cabinets. This was to be expected, for much of the growth of the radio industry has been dependent on the development of better plastics and better uses of plastics in components and cases. A glance at the chart below will prove the point:

Year	*Total radio sets (including phonographs and automobile sets, and table models)*	*Table models*	*Plastic cabinets*
1937	8,083,000	3,580,000	904,000
1938	7,141,000	3,575,000	1,420,000
1939	10,759,000	5,400,000	3,200,000 (est.)
1940	11,859,000	5,516,000	3,600,000 (est.)
1941	13,642,000	5,988,000	4,000,000 (est.)
1942	4,307,000	...	...

The figures are from the production records of the radio industry. The estimates are those of radio manufacturers based on their own records. And these men further estimate that between 70 and 80 percent of the table and "personal" radio models sold in 1946 will have plastic cabinets. What this will mean in figures for next year may be roughly calculated by adding in the factor of new manufacturing facilities: there were 57 licensed radio receiver manufacturers in 1942, but there are 116 licensed today!

The market for small radio sets in plastic cabinets is a long way from saturation, because many prewar sets are either relatively obsolete or worn out, and because Americans generally use more than one radio per family. At present 30,500,000 homes in the United States, or 83.5 percent of all homes, have about 46,300,000 radio sets of which 7,100,000 were not in working order in April 1944, according to WPB surveys. All of which leads the war-expanded radio industry to plan for a production of 25 million radios in its first full postwar year. Between 7 and 8 million of these will be table models, of which 5 to 6 million will be in plastic cases.

Several developments have widened the opportunities for the use of molded phenolics and ureas and cast phenolics in radio cabinets. The first is the general improvement in

5—White and red are the colors in which this phenolic radio housing has been made available by Meck

8—Case, handle and knobs in this Garod radio are of cast phenolic; the dial is fabricated from vinyl sheet

9—Urea formaldehyde is the material employed by Garod for the housing of their combination table model radio

10—*To achieve the brilliant white of this small radio, Stewart-Warner sprays the phenolic housing with paint*

11—*The marble-like cast phenolic housing of this second Stewart-Warner radio is highlighted by white louvres*

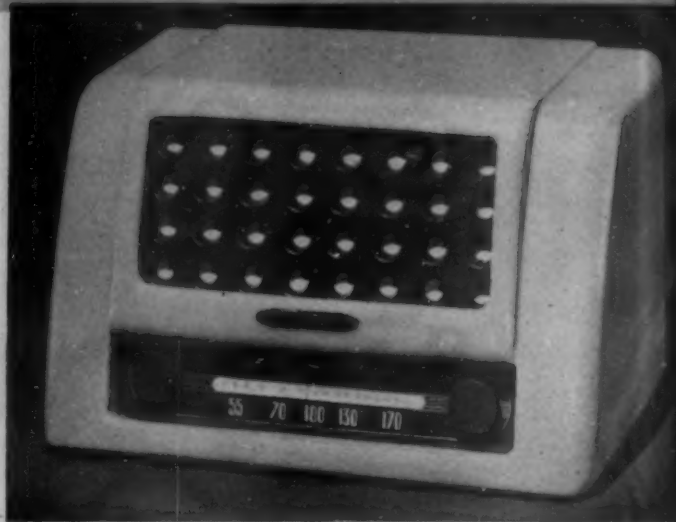
cabinet design brought about by closer cooperation between radio makers and plastics molders in developing good-looking cabinets which would have proper structural qualities. This was predicted in MODERN PLASTICS, March 1940. Another major improvement was that of the Alnico No. 5 speaker which is far smaller, lighter and more efficient for small cabinet use than previous magnetic speakers. The advantage of this speaker is that it is relatively unaffected by the housing in which it is placed.

Other improvements over prewar models involve: extruded and printed or engraved strip dials made of vinyl resin, cellulose acetate or polystyrene, and placed on an angle (frequently at the top of the set) so that the dial can be seen from various positions; speaker grilles or louvres of plastic made separately from the cabinet and attached in assembly; vinyl-coated wire assemblies; greater color contrast, achieved by spraying over masks on cabinets made from a single mold; the standardization of plastic uses in tube bases, coil forms, capacitors, bushing insulation, sockets, terminal strips and wire insulation, which is generally vinyl; plastics in backplates for appearance and strength.

Illustrated herewith are eighteen of the new models. It may interest readers to refer to MODERN PLASTICS for September 1940, where the last prewar models were described, and note the plastic cabinets and components. The radios described in the present article are but a few of the many hundreds of sets now coming on the market, but they serve to show the continuation of the prewar trend toward the use of plastics in radio manufacture and to illustrate some of the current application of wartime improvements.

Figure 1. Emerson Radio and Phonograph Corporation features this table model in a Catalin housing. The front grille which can be made with either round or square holes, is compression molded of Lucite. The entire face of this part is flat, but the inside is convex over the enamelled disk dial, to give the effect of a large lens. Knobs are polystyrene which are sometimes sprayed with gold. Over each knob fits a crystal clear polystyrene knob cover. As on all Emerson table models, a plastic backplate is a feature of this unit. Some models use compression molded phenolic or urea backplates while others use injection molded polystyrene covers.

Figure 2. Emerson's Phonoradio has a plastic-bonded



14—*Teletone uses a separate grille with this molded urea case so that a variety of effects can be achieved*

plywood case with the new "Miracle Voice Grille" made of Mesh-Tech. This consists of a thin 3-ply panel, less than $1/16$ in. thick, with faces of mahogany, maple or walnut veneer over a core of vulcanized material containing long cotton fiber, giving a panel that is tough, hard, dense and light in weight. Bonded with a phenolic resin adhesive, the plywood grille is made by the hot-plate method in large panels which are fed through a perforating die and then cut to exact size. Polystyrene is used for the dial and acetate for the pointer on this model. Knobs and knob covers for this model are again made of polystyrene.

Figure 3. Viewtone Company introduces this 5-tube model in a molded urea-formaldehyde case, with the "button" effect of the grille design carried out in the knob protectors, molded integrally with the cabinet. The dial scale is a clear vinyl material, engraved and filled in, with a diffusion plate of Lamicoid laminated translucent phenolic underneath. The use of this plate produces a nice illuminated effect. The dial scales, rounded and placed at the top of the cabinets, are seen from any position. *(Please turn to next page)*

12—*De Wald uses solid-colored grilles as a contrast to the cast phenolic cabinet which comes in various colors*

13—*An unseen point of difference in this De Wald table model radio is the plastic base for the loop antenna*

15—*Urea, cellulose acetate butyrate and vinyl are all used by Hoffman in this streamlined table model radio*

16—*The dial assembly that is used on this molded phenolic housing of Admiral is molded of cellulose acetate*

17—*Phenolic for the case and knobs, vinyl for the dial and acrylic for the pointer was Crosley's material selection*

18—*A special feature of this Howard radio is the loop antenna mounted on a frame cut from laminated lignin*

Figure 4. Another Viewtone model uses a cast phenolic cabinet in a variety of colors, with an injection-molded Lucite sound grille and knobs. This set also has a vinyl-engraved and screen-printed dial scale at the top front of the cabinet.

Figure 5. John Meck Industries, Inc., are manufacturers of this five-tube model molded of Bakelite in white and red. The dial is molded in and color applied in assembly.

Figure 6. Polystyrene is the material used in the case of this personal pocket radio of the Radio Corporation of America. One-third smaller than the company's similar prewar unit, it measures $3^1/_4$ by $4^1/_4$ by $6^1/_4$ in. and weighs only $3^1/_2$ lb. with batteries.

Figure 7. R.C.A. Victor's No. 56 X table model is compression molded of phenolic with knobs of the same material. It uses the slanting top strip dial featured in many of the new radios, but with a traveling bull's-eye pointer.

Figure 8. Garod Radio Corp. offers this Catalin cast cabinet model 6A1, in maroon and white, with a handle that slides down flush with the top. Knobs are machined from Catalin rod stock, and the dial is drawn from Vinylite sheet printed in color to contrast with the dial background. The surface on which the calibration is printed is tilted at an angle of 30° to permit easy reading from any position.

Figure 9. Garod's radio-phonograph model 5AP1, is molded from ivory urea formaldehyde and uses black Tenite knobs. The design of this case is worthy of note, because it was planned for easy molding in a single piece while allowing for heavy sections where necessary. This unit also has the convex Vinylite dial with the easy reading feature.

Figure 10. Stewart-Warner Corporation has brought out this model in both ivory and walnut. The light color is achieved by spraying a black phenolic case with ivory paint. The walnut model has phenolic knobs to match it; the ivory model uses ruby knobs molded of phenolic. The set features the slanting dial which is designed for plastic, with a glass window over the traveling pointer.

Figure 11. Catalin is used for yet another Stewart-Warner radio which is available in black with gray marble grain effect. Louvres of white Catalin are made separately and set in. The knobs are cut to match the grilles. This company is working on the possible use of polystyrene, and on other plastics possessing electrical properties suitable for loop antenna construction and for coil forms.

Figure 12. De Wald Radio Manufacturing Corporation is producing 14 plastic models from 4 sets of dies. The harp-shaped cabinet is Catalin and comes in a variety of colors, with contrasting grille strips in front of a fabric sound louvre. The dial is slanted and positioned at the top of the cabinet. Knobs are molded of urea.

Figure 13. Molded Bakelite cabinets are used to house this series of De Wald radios. Vinyl dial faces are a feature, while knobs are Bakelite. The loop antennae inside De Wald models are mounted on plastic bases.

Figure 14. Teletone Company's first postwar model is housed in this urea cabinet with separate grille which can be changed in order to give various different effects, in this way providing several models from the one set of molds. The dial, placed on a slant at the bottom of the cabinet, is of vinyl with an orange-colored Lucite dial pointer which glows from the dial light. The company is introducing with this set the "Radioptikon" aerial, a development of the search coil in mine detectors made by them during the war and used in front of tanks and jeeps to detect land mines. The new aerial will be a triangular loop inside the set and will be on a plastic mounting.

Figure 15. Hoffman Radio Corporation uses Beetle of ivory color in the construction of this cabinet. Knobs are made from Tenite and are designed to fit the contours of the recesses at either end of the front of the cabinet mold. Escutcheon plates are engraved thermoplastic, and the dials are convex extruded strip material with needles behind them.

Figure 16. The 6-tube set featured by Admiral Corporation is in a Bakelite cabinet either in natural walnut or with an ivory finish sprayed on after molding. The dial assembly is injection molded of Lumarith, with color sprayed on the back, except for the rectangular center portion which is left clear so that the pointer may be seen. Thus, the border of the dial is translucent while the center is clear. The dial assembly is fitted with two cellulose acetate knobs in colors matching the sets.

Figure 17. The American Overseas table model radio by Crosley Corporation is compression molded of Bakelite, Durez, Insurok and Resinox. The large square dial, with foldback at top for three-dimensional effect, is made of sheet Vinylite. Knobs are phenolic to match the cabinets; pointers are of Plexiglas. Cabinets are walnut, black, brown or sprayed with ivory finish.

Figure 18. Howard Radio Corporation has marketed this set in walnut or black Durez, natural or sprayed with ivory synthetic enamel. A special feature is the loop antenna attached to the back of the set. This is mounted on a frame stamped from standard $^1/_{16}$-in. Lignolite 130.

They're for plastics

Comment by radio manufacturers and their engineers on the use of plastics in radios is interesting. From the man who looks on plastics as a fad, "just like the motor car," to the man who firmly states that in table models plastic cabinets have quite as satisfactory tonal quality and use strength against normal hazards as any other materials, these men heartily endorse the increased use of plastics in radio construction. And to a man, they credit the molders with a big contribution to present successful production by their research work on molds, methods and design.

The material and the molder (by picture number)

Figure 1. Emerson: Housing fabricated by Plastic Turning Co., Inc., and Technical Plastics Co. Grille molded by Waterbury Companies, Inc.; Victory Plastics Co.; Plastimold, Inc.; and Prolon Plastics Div., Pro-Phy-Lac-Tic Brush Co. Knobs and knob covers molded by Standard Products Co. and Prolon Plastics Div., Pro-Phy-Lac-Tic Brush Co. Polystyrene backplate molded by C. F. Church Mfg. Co. and Plastimold Inc.

Figure 2. Emerson: Pointer by C. F. Church Mfg. Co. Knobs and plate by Standard Plastics Co. Voice grille by Hood Rubber Co., Div. of B. F. Goodrich Co.; and Technical Ply-Woods. Cabinet by Duramold Div., Fairchild Engine and Airplane Corp. and Grosfeld House, Inc.

Figure 3. Viewtone: Cabinet molded by C. F. Church Mfg. Co. Knobs by Plasticraft Products Co. Dials by Screenmakers and Etched Products Corp. Designed by Martial & Scull.

Figure 4. Viewtone: Grille by C. F. Church Mfg. Co. Knobs by Plasticraft Products Co. Vinyl dials by Screenmakers and Etched Products Corp. Designed by Martial & Scull.

Figure 5. Meck: Housing molded by New Products Co., Plastic Molders and Richardson Co. Cabinet styled by J. Gordon Lippincott.

Figure 6. R. C. A.: Housing molded by Santay Corp.

Figure 7. R. C. A.: Cabinet molded by Molded Products Co. and Mack Molding Co. Knobs molded by Molded Products Co.

Figure 8. Garod: Knobs by Chicago Die Mold Mfg. Co. Dials by Croname, Inc.

Figure 9. Garod: Cabinet molded by Waterbury Companies, Inc. Knobs by Chicago Die Mold Mfg. Co. Dials by Croname, Inc.

Figures 12 and *13.* De Wald: Cabinets designed by Ted Mehrer.

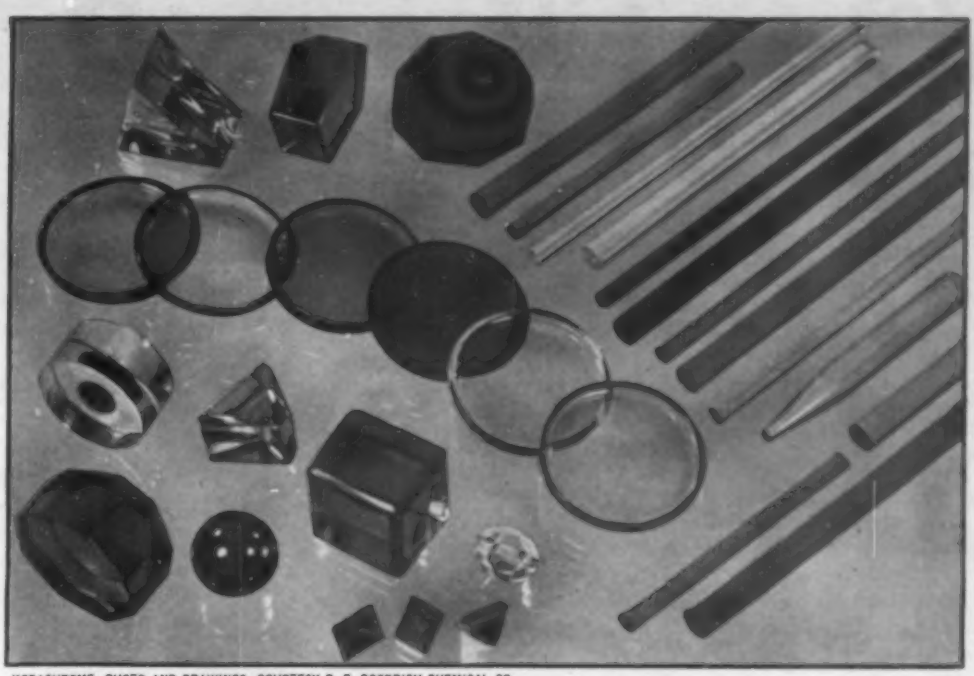
Figure 14. Teletone: Designed by Martial & Scull.

Figure 15. Hoffman: Housing molded by Reinhold & Geiger. Knobs by H. Paulis Plastics Co.

Figure 16. Admiral: Cabinet molded by Molded Products Co. Dial assembly by Superior Plastic Co.

Figure 17. Crosley: Housing molded by Kurz-Kasch, Inc., Richardson Co., Chicago Molded Products Co., International Molded Plastics Inc., Plastic Molding Corp., Santay Corp., Standard Molding Co., Chicago Die Mold Mfg. Co., Recto Molded Products Inc., Metal Specialty Co.

Figure 18. Howard: Cabinet molded by Howard Radio Co.



KODACHROME, PHOTO AND DRAWINGS, COURTESY B. F. GOODRICH CHEMICAL CO.

1—Crystal clear in the natural state, allyl ester may be produced in transparent, translucent or opaque colors. While the transparent colors are achieved either by dyeing the polymer or the monomer; the translucent and opaque colors are obtained by pigmentation of the monomer before casting

A tailored allyl ester

by SAM L. BROUS*

VOLUME change occurring during polymerization has, in the past, been somewhat of a deterrent to the wide commercial use of allyl esters as plastics. To overcome this deficiency and make more practical the use of this chemical type in the casting and contact laminating fields, B. F. Goodrich Chemical Company researchers, Drs. J. A. Bralley and F. B. Pope and a number of collaborators, have developed and synthesized a tailored allyl ester, called Kriston.[1] Not only does this new polymer have improved chemical resistance but it has better electrical and optical properties. Of the thermosetting type, the allyl ester provides a rigid plastic material with exceptional heat and flame resistance (being infusible and self-extinguishing).

Simplicity keynotes the fabricating processes—heavy and costly processing equipment such as mills and presses being virtually unnecessary.

Up to the present time most of the development work has been in the field of rigid products. There is, however, substantial evidence that the new material can also be produced in semi-rigid and even elastomeric forms. This, together with the possible inclusion of modifiers, plasticizers and fillers, provides the basis for a wide range of compositions of varying properties to meet specialized service requirements.

Suggested applications

Approximately one-half as heavy as glass, this allyl ester can be ground and polished with considerably more ease. In fact, lenses have been ground to perfect correction on regular equipment and at a considerable saving of time. Combined with excellent clarity and a refractive index higher than that of most optical glass, this property makes the new plastic a promising material for lenses, prisms, reflectors and refractors. For optical uses where great precision is not required, it should be possible to cast the part so that very little or no finishing would be necessary. Some suggested products are optical contact lenses, viewing glasses in chemical process control instruments, cast camera lenses, decorative pieces for the home, window display stands or decoration, illuminated sign parts or any other application where the required beauty, transparency or translucency of product can be obtained by the casting process in fabrication.

Preliminary tests indicate that the polymer is relatively stable electrically over the temperature range of −10 to +140° C. While at room temperature it appears to rank third in comparison with polystyrene and polyethylene, its maintenance of good electrical and physical properties at the elevated temperatures and its chemical resistance at normal temperatures suggests wide application in the electrical industry—particularly in appliances where rigid or semi-rigid insulating members may be required. An insulator molded to the same design as that of a high voltage porcelain insulator showed tracking at 27,000 volts whereas the porcelain tracked at 31,000 volts. There was no carbonization on instantaneous flash-over. Such electrical parts or control panels, rigid insulating sheets or separators, control knobs, or cast parts for switches, fuse boxes, amplifiers and similar equipment should be good applications of this allyl ester.

Numerous uses in the food and petroleum industries are suggested by the material's resistance to fats, oils and greases. Chemical operators will be interested in the stability of the allyl when exposed to a wide variety of reagents.

The material also seems suited to use in laminated structures. Already glass wool, glass fabric, cotton fabric, paper, asbestos and wool have been laminated with Kriston by con-

* B. F. Goodrich Chemical Co.
[1] Trademark of B. F. Goodrich Chemical Co.

TABLE I. PROPERTIES OF KRISTON

Properties[a]	*Test method*	*Value*
Specific gravity	A.S.T.M. D 792–44 T	1.34 to 1.40
Flammability, in./min.	A.S.T.M. D 635–41 T	Self-extinguishing
Coefficient, linear expansion	A.S.T.M. D 696–42 T	9×10^{-5}
Dielectric strength, v.p.m. (step-by-step, 0.017 in. thickness)	A.S.T.M. D 149–40 T	1275
Dielectric constant	A.S.T.M. D 150–42 T	(See Fig. 3)
Loss factor		(See Fig. 3)
Vol.resistivity, 10^{14} ohm-cm.	A.S.T.M. D 257–38	
(a) Over the range −10° to +110° C.		Too high to measure
(b) At 120° C.		6.8
(c) At 130° C.		6.2
(d) At 140° C.		2.2
Refractive index, 20/D	A.S.T.M. D 542–42	1.57
Hardness, Rockwell M	A.S.T.M. D 785–44 T	116
Compressive strength, p.s.i.	A.S.T.M. D 695–42 T	19,600
Specific heat, cals./gm./°C.		0.26
Heat distortion point, °F.	A.S.T.M. D 648–45 T	
At 66 p.s.i. fiberstress		226
At 264 p.s.i. fiberstress		190
Chemical resistance, percent change in wt. when immersed 7 days	A.S.T.M. D 543–43	
Sulfuric acid (30 percent)		+0.07
Sulfuric acid (3 percent)		+0.13
Nitric acid (10 percent)		+0.12
Hydrochloric acid (10 percent)		+0.13
Acetic acid (5 percent)		+0.15
Oleic acid		+0.02
Sodium hydroxide (10 percent)		−0.11
Sodium hydroxide (1 percent)		+0.13
Ammonium hydroxide (10 percent)		+0.16
Sodium carbonate (2 percent)		+0.14
Sodium chloride (10 percent)		+0.13
Hydrogen peroxide (3 percent)		+0.16
Distilled water		+0.14
Ethyl alcohol (95 percent)		+0.32
Ethyl alcohol (50 percent)		+0.23
Gasoline		+0.15

[a] A comprehensive study of physical, electrical, optical, thermal and chemical properties is in progress. Results will be reported at an early date.

ventional methods. In the case of glass fibers, the laminated structure was almost transparent because of the similar refractive indices of the allyl esters and the glass fiber.

In the fields of fashion and decoration where eye-appeal must be coupled with utility, the combinations of properties found in this allyl ester should justify its use in a multitude of ornamental products from lamp bases, to jewelry.

Properties of the allyl monomer

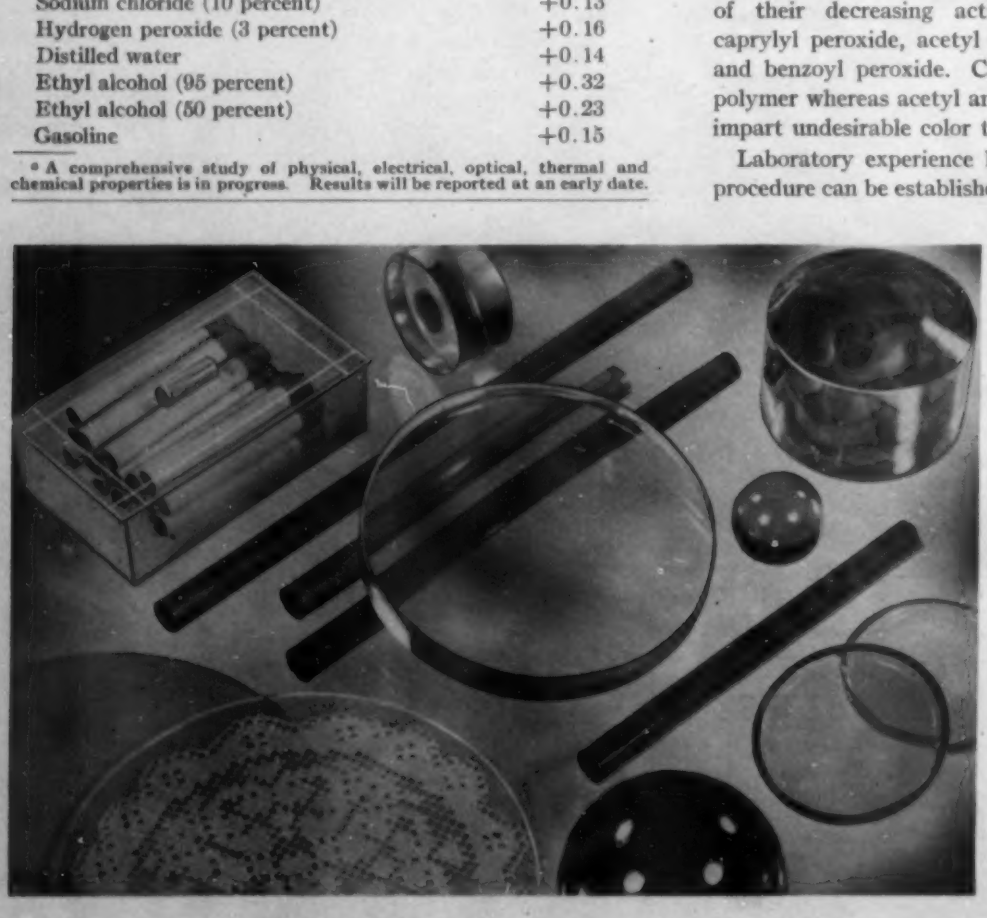
As supplied by the manufacturer, the allyl ester (monomer) is a pure chemical compound, water-clear and of syrupy liquid consistency. It has a high molecular weight with corresponding low vapor pressure and high boiling point. The specific gravity varies from 1.26 at 10° C. to 1.178 at 130° C. (Fig. 3). The viscosity changes from 50,000 centipoises at 22° C. to 12 at 126° C. as is shown in Fig. 4. The refractive index is 1.5483 at 28° C. The monomer is soluble in ketones, esters, ethers, alcohols and aromatic hydrocarbons. Percent shrinkage on polymerization (from monomer at room temperature to polymer at room temperature) is 3.25 to 4.

In the absence of catalyst, the monomer has been stored in glass for months without evidence of polymerization, and it is stable indefinitely when stored at 0° C. In the presence of one percent catalyst, the storage life at 25 to 30° C. appears to be slightly over one week. However, the same system has been stored satisfactorily for a month at 0° C.

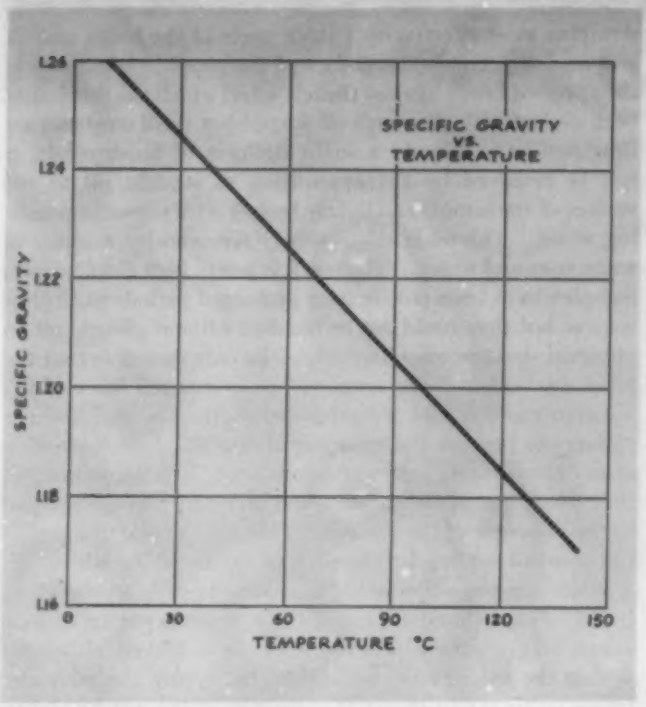
Longtime immersion tests indicate that the uncatalyzed allyl monomer is not corrosive at room temperature to stainless steel, aluminum, brass, copper or magnesium.

Although many types of catalysts have been tested, interest has centered on the organic peroxides. Of these, benzoyl peroxide has proved easiest to handle and most foolproof even though it is slow in its action. The following catalysts have also been investigated and are listed here in the order of their decreasing activity: o-chlorobenzoyl peroxide, caprylyl peroxide, acetyl peroxide, acetyl benzoyl peroxide and benzoyl peroxide. Caprylyl peroxide results in a soft polymer whereas acetyl and acetyl benzoyl peroxide seem to impart undesirable color to the polymer.

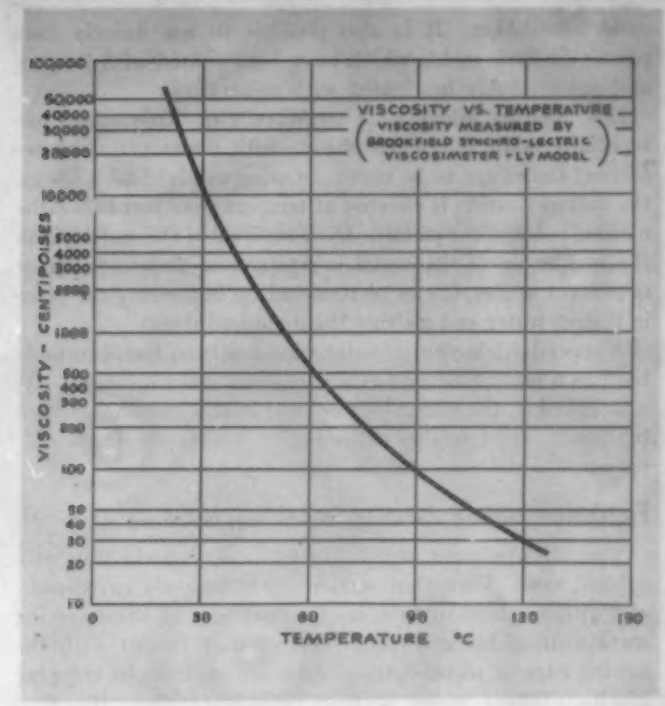
Laboratory experience has indicated that a standardized procedure can be established for preparation of the monomer-



2—These allyl esters can be used in both the casting and the contact laminating fields. For example, there is the lace doily laminated between two sheets of the clear material (left foreground). The varied uses of the cast material are exemplified by the artificial rose embedded in a solid block of this allyl (upper right), the flat disk (center), the rods, balls and coasters



3—*Specific gravity vs. temperature of allyl ester monomer*



4—*Viscosity curve of this new allyl ester monomer*

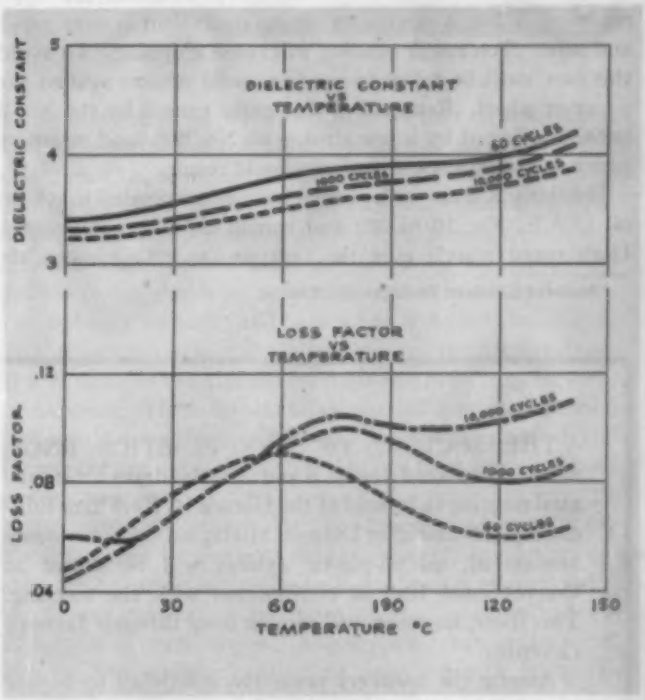
catalyst system. Benzoyl peroxide is pulverized with care and passed through a 100 mesh screen. Then the required quantity of the screened catalyst, which usually is one percent by weight, is suspended in the monomer, as even a distribution as possible being assured by stirring. In the next step the mass is heated to approximately (158° F.) 70° C., care being taken to avoid localized overheating. An oven or jacketed vessel is the preferred means of heating. Occasional stirring will result in a clear solution in a very short time. The catalyzed monomer is then ready to use.

Temperatures above 70° C. will accelerate the polymerization reaction with a corresponding reduction in heating times. Conversely, temperatures below 70° C. will demand proportionately longer periods of heating. It should be emphasized that temperatures much above 70° C. may produce a relatively soft polymer containing abnormally high residual stresses. Since the size and shape of the part to be cast will influence the time and temperature necessary for polymerization, no fixed guides on these variables can be offered.

If an ordinary casting is to be made, the catalyzed monomer is poured into the mold and the whole heated to 70° C. until all air bubbles have risen to the surface and broken. So that no air will be entrapped, mold covers or inserts, if any, should be placed in position with care. If the surface is to be left free, cellophane or some similar material is laid carefully on top to exclude all air from the monomer. Heating is then continued at 70° C. until polymerization has been completed. At this point, the casting is ready for removal from the mold. Cooling should take place gradually.

If cold monomer is poured into a mold, the expansion which results from the heating process will cause an overflow with a subsequent loss of material. This loss can be minimized by charging the mold with preheated monomer at a temperature approximating that used for polymerization.

For laminated structures, the catalyzed monomer is prepared as above. The reinforcing fibers are then treated by any convenient method. Subsequent steps and precautions follow established procedures, heating being done at 70° C.



5—*Chart of the variation of dielectric constant and loss factor of this allyl ester polymer with temperature*

Molds

Preliminary studies indicate that both ferrous and nonferrous metals may be used for mold construction. Since the polymer reproduces the surface against which it has been cast, it follows that polished glass or metal molds will produce surfaces which require little or no further finishing. This is especially important where attractiveness and light reflecting qualities are desired. However, while molds of glass serve exceptionally well, they are, of course, subject to inherent hazards. Neither glass nor metals appear to require

mold lubrication. It is also possible to use densely cast plaster of Paris molds which have been coated with lacquer and subsequently lubricated with mineral oil.

Low melting alloys such as Wood's or Rose metal are especially adaptable when objects with undercutting or re-entrant angles are to be cast. In using molds of such alloys, the polymerization is effected at temperatures just below the melting point of the metal. If, on removal of the casting from the mold, any of the metal is retained in undercuttings or re-entrant angles, it can be removed by immersing the piece in boiling water and melting the undesired metal.

A special, high melting point wax[2] has been found suitable both as a mold liner and as a composite mold material. As a mold lining, the wax is best applied from a gasoline solution by flowing on, brushing or spraying. For molds, the wax is prepared and formed by any practical method.

Finishing—cutting, sanding, polishing, coloring

This allyl polymer is best cut by sawing, preferably with a band saw. Very thin sections (0.05 in.) are cut rapidly and without chipping by using the back edge of a fast moving metal-cutting blade. Thick sections may be cut with the sawing edge of metal-cutting blade although slight chipping results. Where speed is more important than the final finish, the wood-cuttng blade may be used. However, considerable sanding must be done to remove saw marks.

Where saw blade marks or any deep scratches are to be removed, a No. 3 sandpaper or its equivalent is very rapid and safe. Too rough sanding will cause chipping. To avoid this care must be taken to use firm, solid strokes against the paper or wheel. Removal of the marks caused by the No. 3 paper is effected by a few strokes on No. 000 sand or emery paper. A very smooth surface should result.

Polishing is done with jeweler's rouge suspended in a light oil (S.A.E. No. 10 to 30) and spread on a soft felt wheel. High speed wheels give the best results. To remove the scratches most effectively, a thick paste of the rouge and oil is spread directly on the surface of the plastic. The piece is then pressed firmly against the felt wheel which has previously been soaked with the rough-oil suspension. All scratches are thus removed. Should a slight dullness of finish result, it can be removed by the application of straight oil to the surface of the sample and lightly buffing with the same polishing wheel. The oil is subsequently removed by washing in warm soap and water. The result is a very high gloss surface. Samples have been polished for prolonged periods until they were so hot they could not be handled without gloves, yet no apparent damage was observed. The only danger is that the piece may crack if the temperature is changed too rapidly.

Large sanding and polishing belts are necessary for flat surfaces to prevent the rounding of edges and the formation of uneven surfaces. If wheels are used, it is recommended that the radius of the sanding and polishing wheels be equal to the diameter of the sample. This will prevent gouging of the polished surface by the edge of the polishing wheel.

While Kriston polymer in the natural state is crystal clear, it may be produced in transparent, translucent or opaque colors. Transparent coloring may be achieved either by dyeing the polymer or, preferably, by dyeing the monomer before casting. In the latter case, the dyes must be chosen carefully to the end that they do not materially influence the polymerization reaction. Specific recommendations are available as required. Translucent and opaque colors are obtained by pigmentation of the monomer before it is cast. Care should be exercised in the choice of coloring agents.

A study of properties

For studies of properties, allyl ester monomer without coloring or extending agents was polymerized under controlled conditions to a uniform hardness of 40 as measured by the Barcol Impressor. Where a range of values is shown for a property, the data indicate maxima and minima obtained by varying the degree of polymerization (Table I).

[2] Acrawax C, Glyco Products Co., Inc.

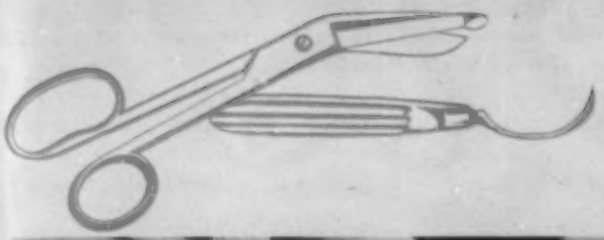
THE SOCIETY OF THE PLASTICS ENGINEERS has selected Jan. 7, 8 and 9 as the dates for its annual meeting to be held at the Horace H. Rackham Educational Memorial in Detroit, Michigan. As previously announced, an all-plastic exhibit will be shown at Conventional Hall in conjunction with the meeting. This show, however, will remain open through January eleventh.

Among the speakers presently scheduled to appear at this annual meeting which is under the direction of Chairman Thomas E. Orr, Plastic Engineering, Inc., and vice-chairman George K. Graves, Jones Dabney Co. are: Dr. Stuart Douglas, Carbide & Carbon Chemicals Corp.; Dr. Gordon M. Kline, National Bureau of Standards and technical editor of MODERN PLASTICS magazine; and Dr. Windleman, Dryden Rubber Co. The subjects to be discussed at the three morning and afternoon sessions include materials, laminates, tool design, coatings, molding techniques and product design.

The committee chairmen in charge of plans for the meeting are: John A. Mickey, Ford Motor Co., in charge of the speakers; W. R. Walsh, Monsanto Chemical Co., in charge of the exhibit; Paul M. Jensen, Dow Chemical Co., handling the program arrangements; L. D. Lamb, Durite Plastics, in charge of operations; Carl H. Whitlock, Monsanto Chemical Co., in charge of registration; Harry J. McGowan, Bakelite Corp., handling hotel reservations; Chas. F. Hamilton, Franklin Plastics Div., Robinson Industrial, Inc., in charge of the reception; Fred Conley, F. Conley Co., in charge of publicity; and Phil Robb, Hercules Powder Co., handling the arrangements for the banquet.

Every effort is being made to assure the success of the plastics exhibit in the belief that industry is anxious for an opportunity to see what advances have been made by the plastics industry during the war years. To this end many of the new materials, new processes and new machinery will be featured at this showing which should do much to convince industry that plastics are ready to help them in the development of new lines of civilian merchandise.

Nylon surgical gauze*



Scarcity of surgical gauze in an Army hospital led to the discovery that dressings of non-adherent nylon screen were ideal for wounds, skin grafts and burns

IMPROVISED surgical dressings of nylon window screening, pinch-hitting for paraffin-treated gauze in an Army field hospital, were found to keep wounds so clean and to allow such rapid healing that Army surgeons began an investigation which resulted in a superior non-adherent dressing.[1]

The tendency for surgical dressings to adhere to raw wound surfaces has probably plagued both surgeons and patients since the dawn of civilization. From the rare and costly ointments of ancient times to the refined products of today, various expedients have been tried to prevent dressings from adhering to damaged body tissues and from obstructing free drainage of blood, serum, pus or waste from the depths and surfaces of the wound which, if dammed back, frequently result in delayed healing, irritation and at times extension of infection. Now, a solution for these difficulties seems to be in the use of nylon surgical gauze which evolved as a result of experiments with dressings improvised of nylon screening.

Problems of dressing wounds and burns

The evolution of improved techniques in surgery which developed in U. S. military hospitals overseas during the war, made new superior dressing materials an absolute necessity.

In less than five years, the routine of treating compound fractures by the local application of sulfanilamide to the wound followed by light packing with gauze impregnated with petroleum jelly, and a plaster of Paris cast has been almost entirely abandoned. As life-saving as the Orr-Trueta treatment proved to be, it always had the drawbacks of foul-smelling casts, prolonged wound healing and later skin grafting in many cases. With the advent of penicillin therapy, early definitive surgery can safely be undertaken, followed within 3 to 10 days by secondary closure of wounds and skin grafting. Soft tissue wounds and severe burns have been successfully treated by similar methods. This modern routine, however, requires a flat, porous, stable, non-adhering dressing. It has the advantage of eliminating foul-smelling casts and permitting more rapid healing of wounds, thus shortening the convalescent period.

Added to the problems normally present in surgical treatment, military surgeons had to face the fact that the exigencies of evacuation and transportation often require the dressings and casts be maintained for days—or even weeks—without changing. These factors all demanded a wound covering which would not adhere, permit free passage of exudates, and give support and protection after surgical treatment has been given to the injury.

Some additional criteria for the dressing are that it be: smooth in order to prevent friction; durable in various climates; water resistant; non-toxic to human tissues, cells, body fluids; neutral to bacterial action; chemically inert and capable of sterilization. Moreover a fabric was needed which was soft, flexible, lightweight, easy to handle, relatively low in cost and capable of mass production.

Typical non-adherent dressings

Most dressings failed to meet all of these requirements of the military doctors or were found to be difficult to prepare and store. Petrolatum gauze, the most widely used bandaging, has a number of disadvantages. In the heat and high humidity of the tropics, it often acts as a moisture-entrapping foreign body in the wound. A petroleum paraffin treated gauze gave excellent results, but the excessive care needed for its preparation and sterilization rendered it unsuitable for mass production or field service. Even cellophane covers from individual cigarette packages, when suitably perforated, have been used as transparent wrapping materials for the dressing of open wounds. (*Please turn to next page*)

* Material prepared by Capt. Robert Bingham, 25th Evacuation Hospital, U. S. Army.

[1] In view of the experimental status of the determination of the fiber, weight and mesh best suited to surgical requirements, the Army had not yet made nylon surgical gauze a standard item of issue.

The treatment of burns has been advanced by the adoption of certain synthetic fabrics as bandaging material. A fine woven, sheer, smooth rayon cloth has been utilized as the basic layer for a pressure type dressing due to its low coefficient of friction and to the fact that it does not adhere to wounds or to raw burned skin. Fiberglas cloth has also been applied successfully. However, the extremely tight mesh of both these fabrics obstruct the discharge of pus and necrotic tissue except by absorption. This quality makes them less suitable for wounds than for first and second degree burns.

Development of nylon surgical gauze

During the summer of 1944, a shipment of olive drab plastic insect screening cloth reached an Army hospital in the Solomon Islands. Army surgeons, familiar with nylon in sutures for orthopedic operations and cognizant of how well it was tolerated by body tissues, immediately pounced upon the fine mesh screening with its smooth glossy finish as a possible dressing to replace the then scarce and difficult to prepare paraffin-treated gauze. Sections of the screening, after being cut, washed and sterilized, were used in both the operating rooms and in the wards. It was tested under both field conditions and in the finest modern hospitals constructed by the Army in the Russel Islands, in Espiritu Santo in the New Hebrides and in Luzon in the Philippine Islands.

A total of 60 cases were treated with these nylon bandages and kept under observation. There was a notable absence of skin irritation and maceration; the wounds were cleaner and drier than was the case when petrolatum gauze was used; drainage was rapidly absorbed into the absorbent gauze placed on top of the screening; and wound healing appeared to be accelerated. In spite of apprehension on the part of some of the staff doctors it was found that, in no case did the material adhere to the granulation tissue of the wound surface.

Surgeons and patients were pleased at the ease and freedom from pain with which these nylon dressings could be changed. Since the screen was flat and slightly stiff, the granulation tissues in irregular wound cavities would grow out to the screen to form a smooth, level surface—ideal for the placement of skin grafts. The absence of surface bleeding as a result of dressing changes was remarkable and fewer sponges were required. There were no cases of skin sensitivity or irritation that could be attributable to the use of nylon screen.

On the basis of this preliminary investigation, further studies were made to perfect the material for surgical use. Samples were sent to the laboratory service of a U. S. Army General Hospital for microscopic examination and measurement. Specifications were established for the exact diameter of the strands and the proper spacing of the holes, so that the mesh would be sufficiently fine to prevent capillary tissues from growing through it.

The fabric that was finally selected was an undyed, unstiffened, smooth, soft, opalescent-white, glossy cloth with a weave of strands of twisted nylon thread. As a gauze it is woven into a 34-filament, 210 denier nylon yarn in a non-slip mesh of 20 strands to the inch (mesh 20), ideal for large wounds, wound-packing and burns. When a stiffened cloth is desired for covering small wounds, cavities and skin grafts, a finish of 2 percent solution of nylon, type 6, dissolved in isopropyl alcohol is specified.

With a stable, non-toxic, inert, water-resistant, non-adherent dressing available, Army medical and surgical officers have improved their dressing techniques and added several modifications to their treatment of compound fractures, soft tissue wounds, burns and amputations.

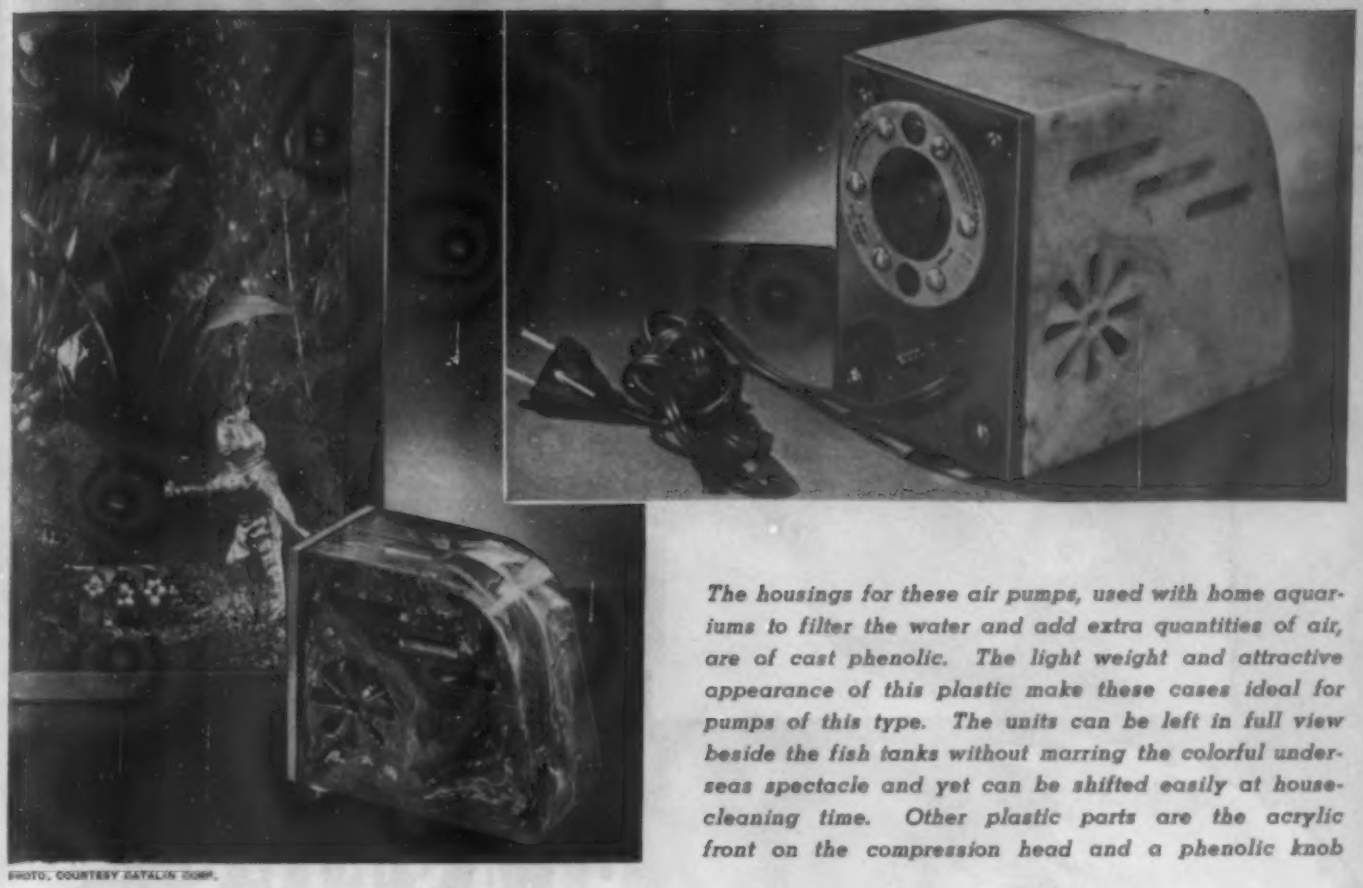
No claims are made that the type of nylon surgical gauze which is described in this article is the final form in which it will be most useful. A finer mesh, a lighter strand, use of the gauze in layers—all might give just as satisfactory results. And nylon is not the only synthetic fiber which has these physical and chemical properties. Any cotton, linen or wool fiber can be processed by plastic finishes to make it water-repellent and non-irritating. Fiberglas, Saran and other heat-stable plastic yarns could easily be woven into a similar type gauze.

First national plastics exposition

THE Society of the Plastics Industry has just announced, through President Neil O. Broderson, that the first national plastics exposition will be held on April 22 through 27 at the Grand Central Palace in New York City. This exhibit will take the form of an industry trade show and is the materialization of a suggestion which first was made at the 1943 Fall Meeting of the S.P.I. Present plans are to hold the annual meeting of the New York section of the Society at the same time as the exhibit.

According to the announcement just released, the exposition is planned around the idea of giving the product manufacturers and designers an opportunity to acquaint themselves more fully with the work the plastics industry is doing, or is prepared to do. As for the molders, fabricators, laminators and machinery manufacturers, the exposition offers an opportunity for them to display their products to the designer, the manufacturer, the architect and the retailer. Arrangements are now being made to invite the attendance of the public on certain days.

The special committee which was appointed on September 26 by the Directors of S.P.I. to investigate the possibilities of an exposition of this type and to evaluate the benefits to be derived, plan now to release more specific details in the near future.



PHOTO, COURTESY CATALIN CORP.

The housings for these air pumps, used with home aquariums to filter the water and add extra quantities of air, are of cast phenolic. The light weight and attractive appearance of this plastic make these cases ideal for pumps of this type. The units can be left in full view beside the fish tanks without marring the colorful underseas spectacle and yet can be shifted easily at housecleaning time. Other plastic parts are the acrylic front on the compression head and a phenolic knob

Air . . . for the fish

WHO among us hasn't had a sense of well being after a weekend spent in the open air away from the dust and fumes of industry. Who doesn't feel fresher when the workday is passed in a scientifically air-conditioned office rather than in a room that grows stuffy, then gritty, as windows are closed and opened in an effort to reach a happy balance.

And so it is with fish. They'll live in aquariums where the water is still, freshened only when the tank is refilled. But they tend toward sluggishness under such conditions. Just like humans, fish thrive best in clean, well-aired surroundings.

To achieve these ideal conditions, ichthyologists equip their aquariums with air pumps which keep the water constantly circulating through filters at the same time that they add that extra supply of air. It is this air that we see rising in lazy bubbles from the open end of aerators that vent near the bottom of the tanks. And the filters can be thanked for the brilliant clarity of the water that transmits, unimpaired, the bright colors of tropical fish.

A pump with a cast phenolic housing

One of the most attractive pumps presently marketed for use in home aquariums not exceeding 35 gal. in capacity has a cast phenolic housing. Catalin cases have a number of advantages over metal housings when used on pumps of this or of comparable size. Appearance is perhaps their greatest asset. There is no reason why a pump of such sleek proportions as that shown above should not be placed close at hand beside the aquarium. With such a streamlined form and with such attractive colors it adds rather than detracts from the underwater scenes being enacted so close beside it. In contrast, pumps with metal housings are most often tucked far out of sight, their solid blackness proving unsuited to the gay colors of the aquarium.

Equally important is the light weight of the air pumps housed in cast phenolic. It is no job at all to move the pump from place to place as the water tank is shifted or turned out for a thorough cleaning. And it can be as easily lifted for the routine household dusting. Metal pumps, on the other hand, are somewhat unwieldy and cumbersome to handle.

The how and where of this air pump

The housing of this pump is cast in two parts. Both halves are provided with one flower-shaped and three slot-like openings in the side which permit the free circulation of air around the motor. The machining of these openings and the final polishing and buffing of the case is the work of the Man-Sew Corp., manufacturers of the pump. In assembling the unit, the motor, with the phenolic impregnated cotton cloth laminate front panel and compression head firmly affixed, is slipped inside the phenolic housing. Screws at the four corners of this front plate secure the motor in its proper place and prevent its vibration.

There are two other plastic parts in this air pump which is distributed by the Aquarium Stock Co. and other licensed dealers—the compression head machined from a block of Lucite and the single switch, molded of a phenolic material.

PLASTICS IN REVIEW

1 "Nine years old, and doesn't look a day older than one week!" That's what can be said of this kitchen. It has Vinylite coated cabinets and semi-ridged floor tiles of the same material. Despite nine year's hard service the tiles show no signs of wear; the coating has not discolored, chipped or peeled. Nor have they been affected by water, oils, greases or fruit acids. The pictured equipment was made in the Bakelite laboratories. Mass production has not begun but it seems likely that there will be great possibilities for these plastic materials in postwar kitchens

2 For the bobby-sox trade, this ear muff has been developed. The metal-clipped, nesting, fur-lined muffs are made by L. & G. Manufacturing Co. and the plastic molded bodies of Fibestos by the Northern Industrial Chemical Company. "Skier" muffs come in many colors and are sold with decalcomania pictures of skiers in action that can be applied to the muff by the purchaser

3 Bright touches for the discriminating hostess are these attractive leaf coasters. They are molded of Tenite II by the Aard Company who also distributes them under the trade name "Hollywood Leaf." Stacked in a holder, 6 to 8 in a set, these durable, non-flammable coasters make welcomed gifts. They come in 8 California colors, 3 autumn shades, clear plastic. The leaves can also be purchased in open stock

4 The late comer will appreciate this welcome-home "Nite-T-Lite." The $^1/_{10}$-watt bulb, enclosed in a translucent polystrene case glows softly and without burning much power, lights the way into darkened rooms. The Styron case itself is unbreakable and capable of heavy handling. The ribbed plastic housing is easily assembled with the other components of the light. The case is injection molded. Littlefuse, Inc., manufacture and distribute it

5 Here is a sample piece of Raco bead cabling strap designed for carrying two or more cables. The Durez beads are compression molded in two parts, sealed together and then strung on pliable wire. For connecting both ends of the strap securely, a special metal hook is provided. T. F. Butterfield, Inc., molds the beads for the Railroad Accessories Corporation. The advantages of the strap are many—it can be easily applied with pliers; when tightened, there is no movement of the cable and no abrasion of either cable or strap; the correctly spaced beads will not burn and they allow air circulation under the strap

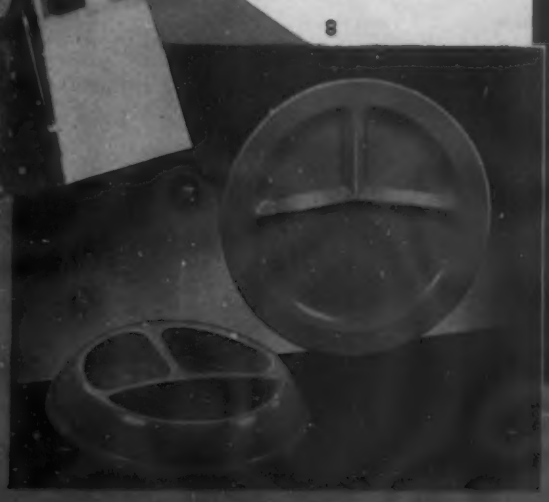
6 Dark clouds won't threaten the possessor of a Monsanto raincoat and umbrella set. The vinyl butyral coated raincoat is particularly praiseworthy, being durable, light in weight, foldable to a package size that can be dropped into a pocketbook, and processed in irresistible colors. The umbrella is made of a vinyl butyral free-film.

7 Thousands of cigarettes for addicted smokers are inspected daily through Lucite tray covers. The use of $^1/_4$ in. methyl methacrylate sheets, instead of metal, enable inspectors to spot damaged cigarettes before they jam packing machines. Trays are shown in use at the Stephano Brothers' factory but are reported to be used by other cigarette manufacturers

8 Special plates for very special people, are the pictured Ba-Bee Dish and Kiddie Grill. Both are compression molded in pink and blue Beetle and Plaskon by the Nichols Plastic & Engineering Co. for Plastributors. Definite points of favor are rounded corners for easy cleaning, non-tipability, non-breakability, and the economy of price

9 Here is a compact, attractive and highly practical vending display molded of Lucite. Constructed in the form of an H, the display will hold 48 batteries and six complete flashlights. The panel in the center not only forms a convenient backing for the housing units but also provides a place for exhibiting information about the products. The Bright Star Battery Co. molds it and distributes it through wholesalers

7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10 The Alden Speare's Sons Co. has introduced on the market a new suction pump for safe handling of acids. With the exception of two metal parts it is entirely fabricated of Saran. The pump attaches to acid carboys and thus eliminates the juggling of carboys and the splashing of liquids. Since the vinylidene chloride material from which it is made is resistant to alcohols, oils, water, and acids, the pump has a wide range of usefulness in transferring bulk perfumes, flavoring extracts, syrups, etc.

11 Glamour and sparkle for milady of the evening is provided by this attractive Lucite bag. It is cut from heavy acrylic sheets, machined by hand and then dyed. The handle is carved from this same material as are the compartment divisions of the bag. Film Star Creations of Hollywood do the fabricating and will distribute it in limited quantities to quality stores throughout the country. The bag comes in clear Lucite and in five colors

12 One place the soft pedal is not wanted is on a motorcycle. Conversely, they must be tough and not easily knicked by heavy heels. Thus the new Tenite II pedals fill the bill. In addition they are lightweight, which helps increase speed; they do not corrode as do metal pedals; and their colorful composition enhances the vehicle. These starter pedals are molded by Sobenite, Inc., for Harley-Davidson Motor Company

13 Adorning halo for Miss "Angel Face" is this John-Frederic's Plexiglas cocktail hat complete with veil and ribbons. It is crystal clear, easily cleaned with a damp cloth, shatterproof, and bound to draw favorable comments from many admirers. Some gay young things prefer to turn the hat around and wear it Gloucester fisherman style

14 "Fresh Paint" for young lips is cleverly enclosed in this tricky case. It is injection molded in three pieces—front, back and hinge pin. The mirror is beaded on by a special process of Design Center, who designed and molded the case for Harriet Hubbard Ayer. Fibestos, Lumarith and Tenite are the materials used in the case.

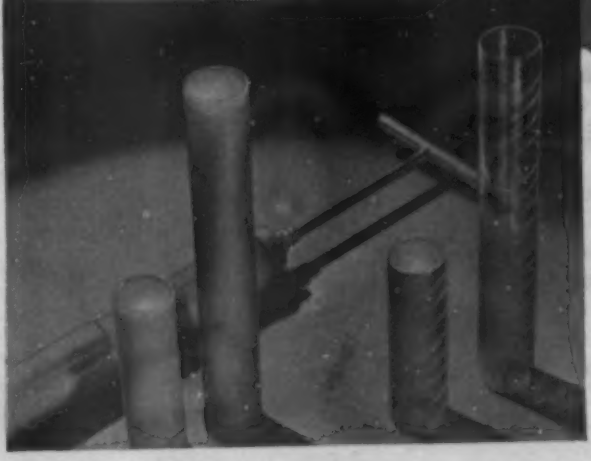
15 Radio active energy, of Atomic Bomb fame, has found its way into civilian life via this little Radi-Glo button. The button itself is injection molded of cellulose acetate. Its back groove is filled with a luminous radium compound and then sealed in by an additional layer of the molding material. Already this ever-glowing gadget has found an unlimited number of uses—marking danger points in home and factory; lighting key-holes, light switches, first aid kits, alarm clocks. J. H. Shepherd Son & Co. manufacture the button for Lustrolite Cleveland Corporation

16 This magnetic phonograph pick-up, which seems destined to replace the old type diaphram pick-up, is housed in a Bakelite case. Wilcox Plastics Molding Co. molds the case in two parts using 8-cavity automatic transfer molds. Electronically heated preforms and double ram transfer molding presses are employed. Caltron Co. is the distributor

17 Adding fuel to the fire is hazardous business, especially when the fuel is gas. To prevent such catastrophies, the Kelly Safety Device Co. has developed a safety cut-off valve. Its vital link is made of Vinylite, formulated to spread, break, or deform at given temperatures and shut off the flow of gas

18 When a container for Silicon sealing compounds was needed for use in sealing guns, many materials did not meet requirements. Specifications called for a strong, rigid, transparent container that was shockproof in low temperatures and always provided complete protection. Spirally-wound Ethocel proved an excellent medium. The upper view shows the container as a cartridge for the dispensing gun. Below: the container caps are sealed on

PLASTICS IN REVIEW



CELLULOSE PROPIONATE PLASTIC*

by DR. RALPH H. BALL†

PHOTOS, COURTESY CELANESE PLASTICS CORP.

Flashlight and portable radio housings are typical uses for this new cellulose propionate

CHEMICALLY speaking, Forticel is plasticized cellulose propionate, made from the reaction of propionic acid and anhydride with cellulose in the presence of a catalyst. Propionic acid is a 3-carbon acid falling between acetic and butyric in the fatty acid series. The propionic acid raw material comes from petroleum raw materials and is manufactured at a new chemical plant of the Celanese Corp. of America in Texas. Although the availability of propionic acid through this new process was an important factor in selecting cellulose propionate as the base for this new plastic, it was by no means the only one. Both chemical considerations and years of laboratory study gave assurance that the properties desired were to be found in cellulose propionate plastic.

A study of the literature on cellulose esters reveals that certain regular relationships hold as the number of carbon atoms in the esterifying acid is increased from acetic to propionic and on through butyric acid. Sensitivity to moisture decreases, but so also does hardness and rigidity to the extent that cellulose butyrate is already too soft for a satisfactory rigid plastic. It is undoubtedly for this reason that the use of the butyric ester in cellulose plastics has been confined to the mixed ester, cellulose acetate butyrate, which has moisture sensitivity and hardness values lying between those of cellulose acetate and cellulose butyrate. These considerations lead to the prediction that cellulose propionate should provide a very desirable balance between low moisture sensitivity on the one hand and adequate rigidity on the other.

Chemical properties

The chemical literature also reveals certain systematic changes in the chemical stability of the fatty acid esters, which lends to the conclusion that cellulose propionate is an unusually stable cellulose ester. This fact has been confirmed experimentally in the laboratory study of Forticel, and there is further evidence of it in the complete absence of any odor of propionic acid either during molding or in the finished article.

Another regular change, no doubt related to the difference in rigidity already mentioned, is that the cellulose esters become more plastic as the number of carbon atoms in the acid increases, so that less plasticizer is required with the higher cellulose esters than for cellulose acetate. In the case of cellulose propionate, it has been found that the plasticizer level is less than 50 percent of that required in cellulose acetate plastic compositions of comparable flexural strength. This low plasticizer level results in excellent retention of plasticizer on aging.

* This paper was delivered before the Society of the Plastics Industry in Chicago, Ill., on Nov. 1, 1945.

† Assistant Technical Director, Plastics Div., Celanese Corporation of America.

An increase in the chain length of the esterifying acid also changes the compatibility of the cellulose ester with plasticizers and solvents. Hydrocarbon compatibility improves. For this reason benzol has appreciable solvent action on cellulose propionate, whereas cellulose acetate is unaffected by it. In lacquer solutions substantial hydrocarbon dilution can be achieved. Similarly among the plasticizers for cellulose propionate, it is found that butyl esters are very compatible and octyl esters can be tolerated to some extent, and triphenyl and tricresyl phosphates are both highly compatible. A much wider selection of non-volatile plasticizers is thus available for cellulose propionate than for cellulose acetate, permitting greater flexibility in formulation.

These changes in compatibility are also apparent in the miscibility of cellulose propionate with other plastics. It does not mix with cellulose acetate, with ethyl cellulose plastic, nor with resinous plastics such as polystyrene. However, it is miscible with cellulose acetate butyrate in all proportions, and either material can follow the other through the molding machine without any defective pieces resulting from incompatibility.

Physical properties

The behavior of the cellulose propionate under impact is quite unusual in comparison with the other cellulose esters. When a curve is plotted relating impact strength to flexural strength for cellulose acetate and cellulose propionate, it is found that the cellulose propionate curve is unusual in that the impact strength rises very rapidly to give high values in a region of flexural strength which is still very desirable, whereas other cellulose esters, as typified by cellulose acetate, have a much more gradual and regular rise. Fortunately these high impact strengths occur at moderate plasticizer levels, where the other characteristics of the compound, such as dimensional stability and stiffness, are also at desirable values. This high impact strength is not confined to soft cheesy compounds. It should also be pointed out that the high strength shown by these Izod values has been confirmed by drop tests on a variety of injection molded pieces.

The lower moisture sensitivity of cellulose propionate, predicted from chemical considerations, is also borne out in practice, and results in excellent dimensional stability. As determined by the A.S.T.M. water immersion test (D 570–42), the range of water absorption for cellulose propionate compositions is from 1.0 to 1.7 percent. In most applications of plastics, it is not the moisture absorption which matters, but the effect of this moisture on the dimensions of the molded pieces. One measure of this is the humidity expansion, determined by drying a specimen completely, measuring it, exposing it to 90 percent relative humidity until equilibrium is reached, and remeasuring. With Forticel the increase in length in going from 0 to 90 percent relative humidity is 0.4 percent.

Another measure of dimensional stability is warpage under hot humid conditions. No figures can be given for this property, since the degree of warpage depends so much on the strains which are locked in the plastic piece at the time of molding. From the water absorption and humidity expansion of this cellulose propionate, good stability against warpage could be predicted, and this has been found to be the case in a variety of accelerated aging tests on a representative group of injection molded parts.

As is the case with the other cellulosic plastics, cellulose propionate can be plasticized and modified in various ways to provide a whole family of plastic compositions of varying properties. From the point of view of the designer and molder this means that the plastic part does not need to be built around the limitations of material, since the plastic itself can be adapted to the job. The range of properties presently developed is shown in Table I, together with the standard physical properties of a typical Forticel molding compound. It should also be pointed out that the specific gravity is approximately 90 percent of that of cellulose acetate plastic, which will result in proportionately more molded parts per pound of cellulose propionate.

One figure in this table requires special comment, and that is flow temperature. The flow temperature range, and the value of 161° C. for the typical composition, may appear to be high. This does not mean that the molding temperatures are high or that cellulose propionate is difficult to mold. It cannot be emphasized too strongly that A.S.T.M. flow temperature is not a reliable guide to molding temperature when different plastics are being compared, although it is a reasonably good guide within the compounds of a single plastic. This is illustrated in Table II, which shows the variation in flow temperature of a group of cellulose ester and ether molding compounds *(Please turn to page 220)*

TABLE I.—PHYSICAL PROPERTIES OF FORTICEL

Property	*A.S.T.M. method*	*Minimum*	*Maximum*	*Typical composition*
Flow, C.°	D 569–43	150	177	161.5
Rockwell hardness, R scale	D 229–43	63	104	97
Specific gravity, 20° C./20° C.	D 176–42T	1.17	1.22	1.19
Distortion under heat, ° C.	D 648–41T	49	66	52
Weight loss on heating 72 hr. at 82° C. (180° F.), %	D 706–43T	0.3	2.2	1.5
Water absorption (24 hr. immersion,), %	D 570–42	1.0	1.7	1.4
Soluble matter lost (24 hr. immersion), %	D 570–42	None	0.1	None
Elongation, %	D 638–42T	25	43	35
Tensile strength, p.s.i.	D 638–42T	2800	6,000	4070
Flexural strength, p.s.i.	D 650–42T	4800	10,000	6730
Impact strength (Izod), ft.-lb./in. of notch		0.8	11.4	7.8
25° C. (77° F.)	D 256–43T			
−40° C. (−40°F.)	D 256–43T	0.7	1.2	0.8
Power factor at 1 megacycle	D 150–42T	0.019	0.032	...
Dielectric constant at 1 megacycle	D 150–42T	3.3	3.5	...

TABLE II.—RELATION BETWEEN MOLDING TEMPERATURE AND FLOW TEMPERATURE

Material	*Minimum molding temperature*	*Flow temperature D 569–43*	
	° F.	*°F.*	*°C.*
Cellulose acetate	465	314.6	157
Cellulose acetate butyrate	465	303.8	151
Cellulose propionate	465	322.7	161.5
Ethyl cellulose	465	288.5	142.5

The artist looks at plastics

There can be no better proof of the adaptability of plastics to sculpture than this torso, carved from cast phenolic by Hesketh. Called "Cadenza," this piece is from the collection of W. W. Crocker of San Francisco

IN the decorative field—in bric-a-brac, objets d'art and small decorative furnishings—plastics have a unique place; but in the field of pure art they have made only brief, abortive appearances. For example, before the war plastics were occasionally used by sculptors, usually by constructivists—those sculptors who build abstract shapes with bits of metal, wood, wire, paper or other material. As labels are even more dangerous in the world of art than commerce, we hasten to quote from the Painting and Sculpture Catalogue of the Museum of Modern Art:

"Constructivism: A movement related technically and esthetically to architecture and engineering as much as to sculpture. It began about 1914 in Russia under the influence of Parisian Cubism, and later spread through Europe and America." By contrast, any sculpture which represents human or animal forms even in distorted shapes that bear little resemblance to nature is "representational."

In constructivist sculpture, plastics have a history dating back to the early days of the industry when such famous sculptors as Gabo and Pevsner (two brothers working respectively in London and Paris) built constructions in plastics and other materials. As Celluloid was then the most available plastic, it was generally used.

Constructivists in this country also used plastic, but, in the years just before the war, cellulose nitrate was superseded by transparent plastics, usually methyl methacrylate, with the result that Lucite and Plexiglas are today the plastics best known to sculptors. The constructivists generally used thin pieces of rod or sheet stock that could be bent into geometric shapes, although abstract heads and figures also appeared.

Most sculptors find a transparent crystal medium unsuited for representational work because details of form are lost in the light distortion. Consequently, since cellulose nitrate and the acrylics were almost the only plastics known to sculptors before the war, representational sculpture was seldom undertaken with this medium unless one excepts industrial display and the large decorative figures at the World's Fair. As the World's Fair figures combined sculpture with lighting in a transparent medium, the resulting effect was a decorative rather than a pure art, and they do not properly come within the scope of this article.

A symposium in which sculptors speak their minds

Like other people sculptors vary in character from conservative to radical, from cynic to idealist, and their views about plastics vary accordingly. Younger and experimental-minded sculptors were eager to explore the opaque plastics; many of them, in fact, had tried to buy the materials before the war. Traditionalists, on the other hand, accepted this untraditional material with misgiving or frankly opposed it. Between these two extremes there were various middle-of-the-road positions.

There were some who suggested that plastics might solve an age old bottleneck of the sculptor's trade—the high cost of his permanent media, bronze and stone. In cost, the comparison is not between price per pound of plastics and bronze, stone or marble, but between the cost of the plastic casting and the bronze casting, the bronze casting and the marble carving. Stone is a relatively cheap material, but stone sculpture is expensive, as is cast bronze. The labor cost makes the price of these traditional media very high, while plastics offer a permanent medium at low cost and a means of inexpensive casting for mass reproduction.

But whether prejudiced for or against plastics, most of the

sculptors interviewed were surprisingly ignorant of plastic materials. Some were under the impression that there was only one material. One sculptor, said to be well informed about plastics, offered to name "the three different plastic materials, generalizing somewhat in their chemical description" as he put it. His classification was: "first, the transparent crystal plastics which are an imitation of glass; second, cast stone, which is merely cement with a little marble dust or stone dust in it; and third, the hard rubber plastic that comes in bright colors on gadgets in the ten cent stores." This amazing analysis, made by an intelligent and well-known sculptor shows how little the artist understands of plastics. Other popular misconceptions were that plastics chip too much to carve, that they are inflammable, and that they cannot be cast.

Most of the sculptors who were interested in plastics had tried at some time to buy large blocks of the material from some of the material suppliers, but had given up when they found that 4- or 5-in. thick rod or sheet stock was all that was available. Thickness is the most important dimension; blocks for carving should be at least 10 in. thick. Most sculptors were unable to understand why a man-made material was available only in slabs thinner than wood. The sizes of the blocks that were requested for carving varied from 8 to 18 in. in width.

Colors, too, have been a disappointment. On the subject of color the sculptors proved to be, almost without exception, extremely conventional, each preferring the colors of the stones or woods with which they worked. The wood carver suggested ebony black, mahogany red and pale mahogany; the stone carver the muted yellows, pinks and grays of stone or marble. Bronze addicts thought of bronze patinas. Though it was universally felt that plastics should not imitate too closely the colors and grains of the natural woods and stones, the force of convention was such that brilliant colors were generally tabooed.

Direct carvers were attracted by the carving possibilities of plastic blocks while sculptors who cast were attracted by the casting possibilities of the liquid plastic (cast phenolic). The present vogue for direct carving in this country is part of the larger renaissance of direct carving which began in Europe at about the time of the last war, accompanied by a vogue for Mayan, Indian and African art. Its theory is that only by direct carving can a sculptor understand his material and make it an expressive part of the finished work. The sculptor who roughs out his figures from the stone without previous clay or plaster sketch interprets his material, it is said, better than the modeler who transfers his plaster sketch to stone, roughing it out to within $^1/_8$ of an in. of the finished surface with the aid of a pointing machine and often with the aid of hired stone cutters. On the other hand, sculptors who employ the modeling technique, say that a previous sketch enables a better planned composition. (It will surprise many to learn that those jokes about the direct carver running out of material at the extremities of his figures actually happen.) Famous sculptors have used both methods and continue to do so today.

Plastics are not for the sculptor

The argument of the traditionalist for traditional materials was well expressed by Jose de Creeft, the Spanish sculptor who came to this country almost 20 years ago as one of the first teachers of direct carving.

"Synthetics," said de Creeft, "are not for carving. From the natural materials—wood, stone or marble—the sculptor gets ideas. They have form or grain which he follows. Take this piece of horn," he said, picking up a bull's horn carved in relief. "Its curve suggests to me my design; I make my design to follow its curve. In the piece of wood which I carve, the shape and figure of the wood suggest to me the composition and design of the finished work. The true sculptor interprets his material.

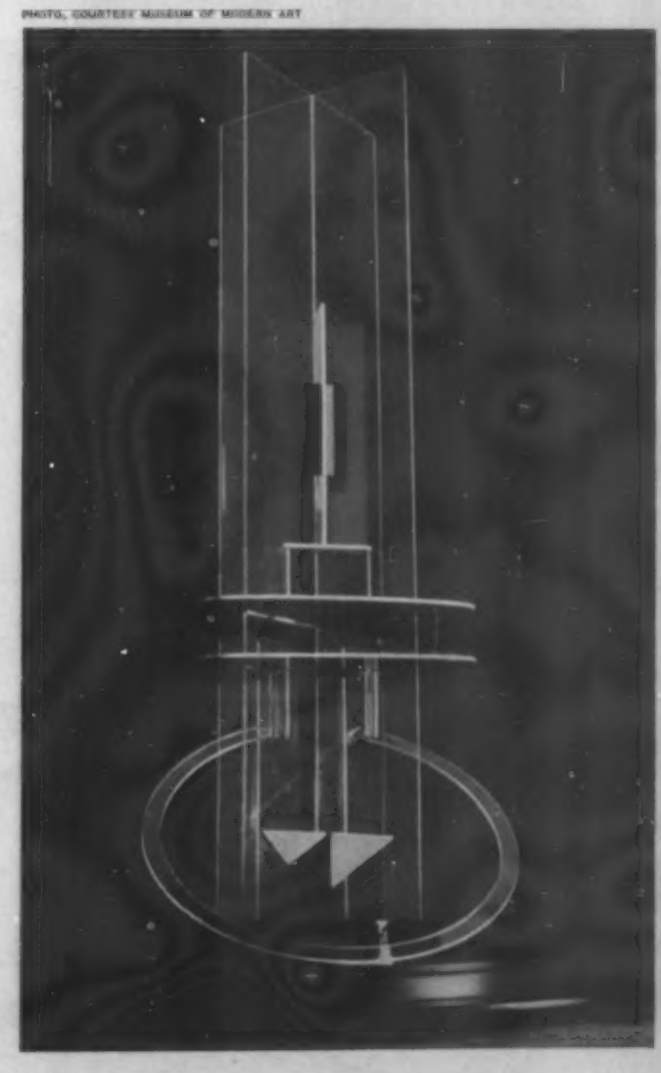
"That is why true sculpture is carving—gravure—with a hammer and chisel. Modeling means clay, and afterwards you transfer the model to plaster and bronze or marble. Clay to plaster to marble! What a confusion of ideas! The sculptor's original conception is lost in the difference of the materials. You cannot conceive a granite carving in modeling clay. The character of the material very definitely directs your efforts.

"Undoubtedly an artist could carve a block of synthetic plastic as well as wood or marble, but synthetics are only for decorative use. They make charming table tops, ash trays, combs, bric-a-brac and other objects of mass production, but they should not be used for carving. If they can be cast in opaque form, they might have advantages for reproductions. But for a direct carver they are not an artistic material.

"Why are they not artistic? It is because they are an unnatural, an artificial material. I have too many ties with the

Typical of the work of constuctionists, the first artists to make use of plastics, is this column built up of plastic, glass, metal and wood. The work of Naum Garbo, the piece is on loan to the Museum of Modern Art

PHOTO, COURTESY MUSEUM OF MODERN ART



natural world to like synthetic materials. But for my children who will have fewer ties with the natural world, synthetics may seem romantic and artistic, a natural material of the sculptor."

De Creeft's argument for natural materials is an interesting one, expressing as it does a common, though seldom voiced, criticism of plastics. It is a prejudice encountered by every new material when first it competes with older materials. Fortunately, it is a prejudice which is forgotten once the new material shows that it can compete successfully in a new market.

In the name synthetics, too, there is frequent misunderstanding. Synthetics suggests to most people an imitation of natural materials. Actually plastics might more properly be called processed materials, since they are as natural in their origins as any other materials, though a step more removed in their processing. Though bronze is accepted by sculptors as a natural and traditional medium, it too, is artificial in the same sense as plastics—that is, it is a combination of several materials in nature!

Habitually, the traditionalist looks with reluctance at new materials, and this would seem to be his real objection to plastics. Far from imitating, plastics have a texture and appearance of their own, and will almost certainly in years to come be one of the conventional media of sculpture, both for decorative sculpture and as a lighter medium for pure art than bronze or marble.

It was notable that most of the sculptors interviewed suggested the subdued and conventional colors of the natural woods and stones, and that bright colors were tabooed. This was not an artistic canon of the sculpture of previous civilizations. The Greeks of the classical period painted their famous marble statues in bright colors, but as the paints have washed off with the centuries, even the memory of the colors has gone so completely that we exhibit reproductions of these marbles in dead white plaster. So, to the public at large, Greek sculpture is a cold and forbidding thing.

The large section of the public that "doesn't know much about art but knows what it likes" would prefer to see color in sculpture, in gay figurines and in children's heads done in a lighter medium than bronze. To younger artists, too, the color possibilities of plastics are one of their chief attractions.

William Zorach, though not an enthusiast for plastics in their commercial guise, made a discerning analysis of the materials, pointing to several possibilities for sculpture. All depended on the production range of colors suitable for sculpture. In the making of plastics for the sculptor, either in liquid form for casting or in blocks for carving, there should be someone to advise about color from the sculptor's point of view—a liaison between the sculptor and the material suppliers. If the sculptor could mix his own colors for casting, that would be particularly alluring; one could get a range of color not now possible.

Another sculptor who expressed himself frankly as a traditionalist preferring wood, stone and bronze as media, was John Gregory. But he was tremendously interested in the possibility of large plastic castings in architectural sculpture. Gregory is well known for his architectural sculpture, and he believes that if plastic castings would weather they would have an enormous use in architecture and building.

Plastics offer new horizons to the sculptor

In discussing the use of a commercial material in sculpture, most of the sculptors interviewed were quick to refute the idea that a commercial material carried a stigma. Chaim Gross, a leading exponent of direct carving in wood, pointed with pride to the fact that he had introduced many commercial woods once thought of as unsuitable for sculpture.

Gross was interested in plastics for carving and had tried to get the materials. In his figures, Gross loves to use the acrobats of the circus, and a whole wall of wood athletes in his studio are poised in permanent action. He would like to carve plastics in similar forms. As a direct carver, he likes to define the nature of his medium bringing out the grain and figure of the wood or other material. For this reason he believes, unlike most sculptors, that brilliant colors will come in the use of plastics, as they are of the nature of the medium.

Though himself interested chiefly in plastics for carving, Gross thinks that plastics "will have a more extensive use in casting where they offer the artist less breakable medium than plaster."

Another direct carver interested in plastics is Ahron Ben-Shmeul. Ben-Shmeul is an authority on stone, and as a stone cutter he was naturally attracted by the harder plastic materials. He had experimented with cast phenolic which he liked for its cutting qualities, but the only sample he had been able to get was too small for anything but a base.

In comparing the weathering properties of various plastics with stone and wood, Ben-Shmeul pointed out that marbles also change color and deteriorate with time, whites changing to yellow, and the pink of Tennessee marble to gray. Wood, of course, cracks or checks with time.

Hesketh is another young sculptor in the direct carving tradition. She is a specialist in hard stone carving, and one of the few women to carve granite. Her interest in plastics is more than theoretical, and she has had two exhibits of carved plastics in New York. Hesketh first exhibited carved plastics at the Ferargil Gallery in 1942; in 1943 she exhibited a large group of plastic figures all carved in Catalin, most of them in deep, jewel-like translucent colors. The beautifully rounded figure on page 123 is carved in translucent greenish

Hesketh used a block of polystyrene, 10 in. square by 12 in. thick, in the relief carving of these two faces

blue with changing color tones like sea water. The torso (page 120) is carved in amber plastic. Each was carved from cast phenolic rod, 5 in. in diameter. Her most recent plastic work is a block of polystyrene (about 10 in. square and 12 in. thick) carved in relief with two faces (page 122).

For her plastic carving, either in cast phenolic or polystyrene, Hesketh uses both wood and stone chisels and hammers, roughing out the figures with the heavier tools, and finishing with files and rasps. Sandpaper, steel wool and pumice stone are all used for polishing. Cast phenolic is very similar to ivory in its cutting qualities though without the grain of ivory, and it can be carved with similar tools. Methyl methacrylate is tougher, though softer. Decorative carvers of both cast phenolic and methacrylate have found it useful to use a motor tool with a carving bur to rough out the figure, followed by finer cut finishing burs. As described by Robert Russin this process is: 1) the sawing away of any large excess with any type saw. 2) Rasping away of further excess with rasp. 3) Carving with motor tool and carving bur. 4) Finishing with scraper, sandpaper and pumice stone. 5) If a high gloss is desired, polishing on a buffing wheel.

Coming from a scientific background, Hesketh had a more experimental approach to new materials than most sculptors, and she picked up her first plastic in a hardware store—a 3-in. phenolic rod broken at one end. The broken end showed a soft color and a figure like the markings of snakewood. To fit the proportions of the rod, Hesketh designed one of her long slender dancing girl figures—the first of a long series of plastic figures in her exhibits.

Though her use of jewel-like translucent colors in plastics, like her use of colored stone such as lithos lazuli, is a departure which might be looked upon as unorthodox by some sculptors, the colors were an immediate rapport for the public at large when her work was exhibited. There was not enough translucency to detract from the detail of form, and the depth of color added great beauty.

Hesketh herself, in discussing the color values of plastics, said that their greatest value and most extensive use should be in cast form as sculptural decorations for houses and buildings where the inherent color of plastics will give an artistic effect not to be equalled by painted decoration.

A new permanent medium for casting

The interest of direct carvers in plastics was altogether unexpected, since plastics were not originally thought of as a medium for carving. For casting, however, they offer unique possibilities—possibilities not to be duplicated in any other material—and it was to be expected that sculptors primarily interested in casting would recognize the advantages to be developed with plastics.

Among sculptors primarily interested in the casting possibilities of plastics was Hugo Robus who is known for his formalized figures with gleaming surfaces in highly polished marble or golden bronze, though his recent work is of a different style. Robus does a great deal of work on the surface of his plaster casts, and his first question was whether plastic casts could be reworked. It would be particularly useful if plastic blocks for carving could be cast in rough shapes rather than in standard sizes, Robus thought.

There is a technique, he pointed out, in learning the casting of any new material, and it would be an advantage if the plastic material suppliers had special departments to handle the problems of the sculptor's bronzes.

Donald de Lue, president of the National Sculpture Society, and known for his idealized allegorical sculpture, at

The color and spray of the sea is in this figure, carved by Hesketh from translucent greenish blue cast phenolic. It is from the collection of W. W. Crocker

once grasped the basic possibilities of plastics in solving an age old economic bottleneck of the sculptor's trade—the high cost of his permanent media, bronze and stone. In the words of de Lue, "The sculptor does not want to sell his work cheaply like the commercial artist. But for himself and for his more popular work he would like a cheaper medium than bronze or marble. Plastics should open a tremendous field between plaster and marble, supplying an in-between material which is

This life-sized head—called Gloria—is typical of the results that can be achieved by casting phenolic resin in molds. The piece is the work of Anita Weschler

light, strong and durable. Cast plastics could make sculpture available to the public and could give the sculptor an inexpensive permanent medium.

"If he has a client, the sculptor who is a modeler can put his work in stone, bronze or marble. But for his unsold work the sculptor cannot afford a durable medium. If he uses bronze, he might have to spend perhaps $400 to have a figure that size cast." He pointed to a figure that stood a little over two feet high. "If he has it pointed and carved in marble it might cost $500. That does not include the price of the months of labor he may have spent on the original model. If, in the casting of, say, a bust, the sculptor could use plastics for an added cost of $50 over plaster and thereby have a permanent medium, that cost would be as nothing compared to the price of a bronze."

Casting of phenolic resins

Cast phenolics are, par excellence, plastic for sculpture and decorative work because of their depth and richness of color and that elusive quality called "life" in plastics and other materials. This lively quality in the cast phenolics is due, in part, to the fact that most of them are colored with various types of aniline dyes. The pigment colors used in many applications of plastics where esthetic quality is not paramount, rob the cast phenolics of their delicacy and life, though they can be used in a few shades such as the opaque ivory.

Originally all cast phenolics were sold by the material suppliers in rods, sheets and other shapes already cast and cured ready for fabricating or manufacturing. In the two years just before the war, manufacturers of objets d'art, art schools and even occasional sculpture studios[1] began to experiment with the liquid phenolic, casting it themselves for decorative pieces and novelties. The ease of casting irregular shapes in phenolic made it an inexpensive means of mass reproduction and in the metal shortage during the war the technique developed for decorative casting was adapted (with some modifications) by industrial manufacturers for casting forming dies, saw jigs, etc.

Molding materials and molds

The rods, sheets and tubes cast by the material suppliers are made in lead draw molds tapered at one end to permit the casting to be easily removed with an air hammer. Any shapes with undercuts such as the famous prewar phenolic hair brushes and animal figures must be made in split molds, usually two-piece split molds. Cored molds are also used, the core being metal or plaster faced with rubber.

Lead molds are used by the material suppliers chiefly because of their cheapness. Although they can be used for only one casting, they are simply made on steel arbors which are dipped into a kettle of molten lead and then into cold water to set the mold. It is obvious that for small scale commercial work and the production of a limited number of reproductions, the initial advantage of cheapness is dissipated by the expense of the steel arbors and the lead equipment; lead molds were found less advantageous, too, for castings with complicated undercuts. A more flexible mold was needed, and experiments were conducted with many types of molding materials by widely separated makers of objets d'art.

Glue and gelatine molds had been known for almost a century as the most flexible molds for a cast with difficult undercuts. They were the first bendable materials known, and their elastic quality allowed the mold to be pulled from beneath undercuts or projections, after which it sprang back into shape. Both glue and gelatine molds can be used many times provided they are properly dried.

All of these mold materials, however, left something to be desired, and the perfecting of latex rubber as a mold material in the thirties solved many problems in the world of casting. Latex molds required less skill in making, and while the average number of casts with good detail from a glue mold ran about 50, the number of plaster casts from a latex mold ran into the thousands. For museum specimens and for sculpture and decorative work, latex molds proved invaluable.

Latex molds are built up in layers by flowing rather than brushing on the latex to the thickness of $^1/_{16}$ to $^1/_4$ of an in., depending on the size of the mold, and on whether the mold is to be used for a hot casting. The present tendency is against the use of fillers, and they are never to be used in casting phenolic resins.

When the war broke out, most of the producers were then using natural rubber latex for their molds, and the allocation of all natural rubber for military manufacturers brought a succession of experiments with synthetic rubbers. Shrinkage was a problem with several of the synthetics cast in these molds. Other problems were excessive air bubbles and insufficient elasticity. Nevertheless, several companies developed successful synthetic latex molds for casting phenolic or other materials. Among the synthetics used were neoprene, buna S, Korogel and Koroseal.

Synthetic rubbers vary greatly and no reliable estimates

[1] Ettl Studios.

for them are available, but one material supplier estimates the life of a natural rubber mold, *if used with an accelerator and a parting agent*, at 60 to 100 castings.[2] Mr. Ralph Mancuso,[3] whose heroic-sized phenolic castings for the World's Fair were the largest ever cast, states that he has used latex molds, if properly lubricated, for several hundred castings. Both of these estimates are for the use of *resin with accelerator*, which enables the curing time for small castings to be cut down to an hour or two at 180° F. On the other hand, Mr. Charles Vermann,[4] whose bird and animal figures were sold in several Fifth Avenue stores before the war, estimates the life of his synthetic latex molds *used in the long heat curing process* without accelerator at three to eight castings.

Another important factor in the life of the rubber mold is the use of a parting agent, and both of the above estimates of accelerator resins were based on the use of a parting agent. Without a parting agent the phenolic casting sticks to the mold causing damage to the surface and reducing the life of the mold to a fraction of the above estimates. Various parting agents are used; one material supplier recommending a parting agent made of one part castor oil and 10 parts of denatured alcohol.

Lubricants such as wax or grease are often used in addition to the parting agent. Mr. Mancuso[3] prepares his molds with one coat of shellac and two coats of lacquer. One specialist in experimental work on rubber, points out that the synthetic latex mold (of whatever material) has the advantage of better withstanding the oil in the parting agent. Though the synthetic molds lack the stretch and elasticity of natural rubber, with careful handling they make durable molds.

The rubber mold is built up in the usual way with successive coats of latex, and continuous molds can be used for figures in the round provided there are no elaborate undercuts. Wide flanges supported by a strip of Celluloid set vertically against the model are a help in keeping such a mold tight through successive castings. However, where a large number of castings are required or where the model has complicated undercuts, a split mold is necessary. The split or piece mold in rubber is made in the same traditional way as a split mold in plaster.

Like glue or gelatine molds, rubber molds are, of course, supported by a plaster shell or mother mold, and after the supporting mold has been poured and set, the resin can be poured into the rubber mold. With phenolic resin, care must be taken to avoid bubbles, and air vents should be built into any closed undercut to allow trapped air to escape. As with glue molds, the resin is poured through an opening at the top of mold, and the casting is then ready to cure.

Heat-cured vs. accelerator-cured resins

The classical method of curing phenolic resins, and still the preferred method for industrial uses requiring great strength, is the long heat curing process. In this process the resin is cured in an oven for 48 to 72 hr. (though very large castings such as the 9-ft. castings for the World's Fair were cured as long as 10 days) at a temperature of 180° F. Phenolic resin can also be acid cured without any heat, using an acid accelerator, or cured by a combination of heat and an acid accelerator. The length of time for curing accelerator resin depends on the amount of accelerator and the amount of heat used. As the use of accelerator resin speeds production and enhances the durability of the rubber mold, it is often used by manufacturers of objets d'art, small decorative castings and buttons. The most usual practice is to use about 7 to 10 percent accelerator with heat, curing the casting in ½ to 6 hr. (for large castings), at a temperature of 160 to 180° F.

Resins with accelerator are not recommended where great strength is necessary in the finished casting, as the accelerator impairs somewhat the compressive and impact strength of the casting, but in decorative castings or small objects like buttons, the slight loss of strength has no effect. The use of an accelerator does not necessarily result, as is frequently stated, in a material which crazes after one or two years. Accelerator-cured phenolic castings have lasted many years without cracking or crazing, though crazing does occur with certain accelerators. Various accelerators are used, e.g., hydrochloric acid or a combination of acid and acid salts.

Another effect of accelerators is that they tend to make the casting opaque, a transparent resin becoming translucent and a translucent resin becoming quite opaque. For sculptors this is not a problem, because, as pointed out earlier in this article, sculptors prefer an opaque medium for representational work, but it is a consideration in the making of novelties. A more important drawback to the use of accelerators is that the acid accelerator has a corrosive action on the aniline dyes generally used for coloring the phenolic resins. To avoid this, acid cured resins can be colored with water soluble aniline dyes or with pigments.

Phenolic resins can also be cast in plaster or wood molds but their use involves special considerations. For the sculptor wishing only one casting of a model, the plaster cast mold is the cheapest and easiest method of reproduction, and one of the material suppliers has cast resin in plaster molds experimentally for several sculptors.[5]

The life-sized head, "Gloria" (page 124) by Anita Weschler, is cast in this manner. For these castings, resin without ac-

[5] Catalin Corp.

This eagle head by Jan de Swart is the type of work which is easily reproduced in a cast phenolic material

[2] Max Hilrich, Marblette Co.
[3] The Art Plastics, Inc.
[4] Just Plastics.

celerator was used, the casting being heat-cured at 180° F. for 48 hours. In every case the casting had a transparent skin or flash to the thickness of 1/16 to 1/8 in. over the entire surface, because of the fact that the plaster dehydrated the resin. This took place despite the fact that use was made of a parting agent.

This transparent skin over an opaque casting would be, of course, a problem in sculpture as it introduces highlights and otherwise changes the original conception of the sculptor. Miss Weschler avoided this effect of too great transparency by reworking the surface of the face, leaving highlights only to accentuate desired effects. The skin or flash can be avoided entirely by the use of resins with accelerator or, since most sculptors prefer an ivory effect in plastic casting, by the use of the heat cured resin with white pigments.

Shrinkage is not a problem in phenolic castings, running only about 0.008 in. per in. in ordinary castings, though in cored molds it may run as high as 0.01 in. per inch. These castings are easily machined, shaped and polished with the same tools and equipment used for metal or wood; they can be fastened together or to other materials with liquid phenolic cements or with screws.

Casting of methyl methacrylate resins

Methyl methacrylate casting is done by three methods. The first is the casting and polymerizing of the liquid monomer used either for casting sheets or for embedding specimens; the second is the monomer-polymer method of casting widely used in denture compounds and for decorative articles; the third, ideally suited to the needs of the amateur and handicraft worker, is the slush molding method of casting polymerized granular methyl methacrylate moistened with solvent. Only the last two of these methods will concern us in this article.

Monomer-polymer casting—The monomer-polymer method of methacrylate casting operates on the principle that the monomer is a solvent for the polymer. The monomer reacts chemically with the polymer, and as it polymerizes more rapidly in the presence of the polymer, this method is faster than the polymerization of the liquid monomer alone. (Even in monomer casting it is a common practice to "seed" the monomer with shavings of the polymer to hasten polymerization.)

This duck was carved from a block of translucent cast phenolic by Robert Russin. The artist's intention in this case was to reproduce the stylized piece by casting

In the monomer-polymer method, methacrylate polymer is moistened with the monomer to a doughy consistency, and then cast in a plaster mold lined with aluminum or cellophane. The lining facilitates removal of the casting from the mold and also avoids moisture entering the casting from the plaster during curing.

The casting is usually done in split or male and female molds, each half being clamped together and put in the oven to complete polymerization at a temperature of about 130 to 160° F. As there is proportionately less monomer (in relation to the polymer) than in specimen casting, polymeratizion is fairly rapid.

Monomer-polymer castings can be either transparent or opaque, and as in all methacrylate casting they can be colored by the addition of pigments or aniline dyes. Pigments, of course, make an opaque casting. In monomer casting there is a tendency for the pigments to settle out heavily to the bottom, making an uneven color, but this does not occur in monomer-polymer casting, and their use has no disadvantages.

Decorative plaques in relief and intaglio have been cast by this method, usually contrasting a transparent polished surface in the uncarved part of the plaque with an unpolished, frosted surface in the carved relief or intaglio. The extraordinary light transmitting qualities of acrylic resins even in opaque form give beautiful effects in plaques, though for sculpture in the round this very quality causes distortion of form. Decorative plaques are cast in ceramic molds as well as in burnished tinfoil plaster molds.

Slush casting of methyl methacrylate—This is the method ideally suited to the amateur and the handicrafts worker, as it requires no special equipment and no precision, although the careless use of too much solvent causes considerable evaporation and shrinkage. In this method the granular polymer (compression powder) is moistened with a low-boiling solvent, such as acetone. The resulting mass is a sludge rather than a liquid, but it is thin enough to pour. The sludge is poured to overflowing into an open mold (either a plaster, metal or rubber mold), and leveled off with a spatula or knife. Molds are frequently lacquered to obtain a smoother finish, but this is not necessary. The low-boiling solvent evaporates by itself at room temperature, leaving a solid casting. The solvent can also be driven off by heat, but although heat cures the casting very much more rapidly, it is not recommended for the amateur, since too rapid evaporation of the solvent causes large voids in the casting.

In this procedure the polymer remains undissolved, the solvent merely moistening each bead enough to hold the mass together. It is not, however, dissolved, as in the slush casting of cellulose acetate.

When the solvent is driven off, its place is taken by air (or contraction), and castings made by this method are opaque because of the air bubbles throughout the whole porous mass. The air bubbles are too small to be seen, however, and for decorative work they are not a disadvantage provided an opaque material is wanted. For industrial purposes the porous material is less strong than an air free casting.

Decorative figurines, Christmas angels and other castings have been commercially made by this method. For the amateur the only caution in its use is the correct control of the amount of solvent. Sizable shrinkage and even warpage may occur depending on the solvent and the size of the mold.

Slush casting of cellulose acetate

Although cellulose acetate (in viscous liquid form) is sometimes cast in large blocks formed under pressure and sliced

As with the duck, Robert Russin carved this polar bear in a style that would lend itself to the production of a mold in which he could cast a considerable number of reproductions

into sheets, this technique is never used in decorative work, and need not be considered here. For decorative work, however, a cellulose acetate (or a cellulose acetate dope) is sometimes slush molded or painted on in layers over a form.

In this procedure cellulose acetate in granular form is moistened with a solvent to the consistency of thick honey or glue. It should be noted that unlike methacrylate slush molding, the cellulose acetate actually dissolves in the solvent. The cellulose acetate dope can be slush molded in plaster, rubber or metal molds, but a more usual procedure is to paint it on over a form. Because of the large amount of solvent used and the large amount of shrinkage which occurs when the solvent is driven off, the dope is usually painted on in very thin layers. The solvent is usually evaporated at room temperature.

This process was first developed by Joseph Mrazek[6] in Czechoslovakia for altars in the churches. After the last war, Mrazek set up a factory in Moravia to make altars with transparent panels of cellulose acetate, which would transmit light in a darkened church lit only with candles. Mrazek, using aniline dyes, developed unusual colors like the stained glass of medieval windows, and his unusual command of colors is one reason for his success in stage decoration.

The future of plastic sculpture

In summing up the forum of sculptors, we stress the fact that this is simply an initial effort at collaboration between the plastic material suppliers and the artists, which should be followed up with specific efforts. The most surprising fact which came out of the discussions was the ignorance of plastics among sculptors. Few knew that there were a number of plastic materials with widely varying properties. Many materals with obvious advantages for sculpture were untried. Laminated wood, for instance, was completely unknown, though it offers a hardness and strength and a variety of figure not to be found in ordinary woods, and it does not check with time. Dimethylol urea, as a treatment for hardening and preserving ordinary wood, was also unknown.

Equally surprising was the number of sculptors who had tried to get plastic blocks for carving (most sculptors did not know of their casting possibilities), and had been universally disappointed in the small sizes of the blocks they could get. If plastics for sculpture are to be encouraged, the sculptors must have blocks of sizable dimensions larger than present rod and sheet stock.

Many sculptors suggested that exhibits of plastics would be useful in familiarizing sculptors with the materials. Walter Rotan advanced the idea of permanent exhibits in the various sculpture societies and of a traveling exhibit which could tour the art schools. Still better, he suggested, would be an exhibit of plastic sculpture. Since plastics, like all new materials, involve the learning of a new technique, the well-established sculptor will be less interested in them than the art student, and art school exhibits will probably be the first to use plastics extensively.

Despite the prejudice of many sculptors, cast plastics will probably be an eventual medium, too, for popularizing sculpture in reproductions. When plastics are used, colors will also be used. Though bright colors were tabooed by most of the sculptors interviewed, this was not an artistic canon of other eras.

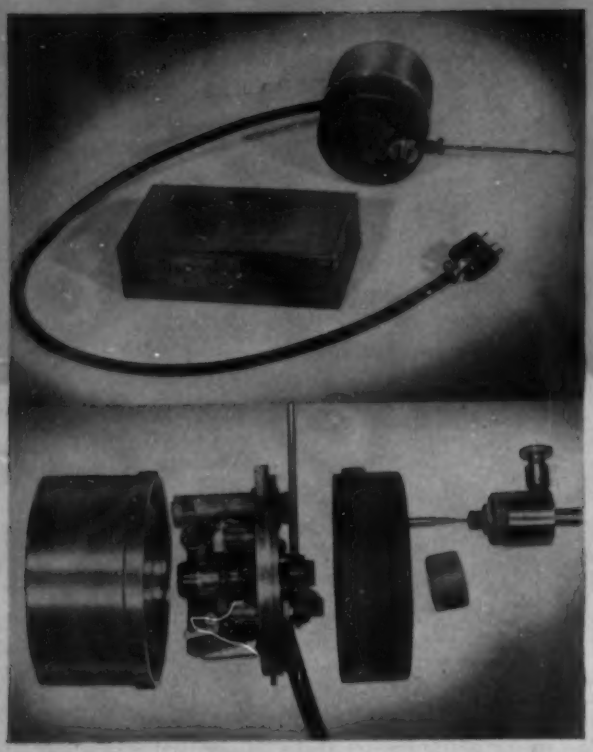
Another use of cast plastic reproductions might be their sale in museums. Horace Jayne of the Metropolitan Museum, in making this suggestion said that the museum has a large demand for plaster reproductions which it is seldom able to supply, as the finishing of the casts is done by artisans whose production is limited and whose work is of uneven quality. He estimated that they could sell many scores of certain pieces.

In summing up the role of plastics in pure art, Monroe Wheeler of the Museum of Modern Art, said: "Creative artists have always worked in all sorts of media. Fine modern art has already been executed in plastics, notably the beautiful constructions of the Russian artist, Naum Gabo. Technical difficulties excite good artists and they will doubtless create works in plastics of great vitality and beauty. Inasmuch as quantity production of some of these works may be feasible, it is not unlikely that works of art in plastics may eventually rival the popularity of prints and reproductions."

Plastics, it would seem have a wider use in sculpture than was originally realized. For casting, particularly, their horizon is unbounded, since, like bronze, they offer homogeneity, the first requisite of a good casting material. They have also a variety of surfaces and textures as yet unknown to the sculptor.

[6] Czecho Peasant Art Co.

PLASTICS



IN ORDER TO MAKE POSSIBLE MORE ACcurate examinations of the reactions of would-be fliers to high altitude and lower atmospheric pressure, Westinghouse Electric Corp. has developed an electronic counter known as a Tympanometer which makes use of a considerable amount of plastic. The unit, which is clamped on the head of the flier, records the number of times he swallows in order to equalize the pressure on both sides of the eardrum or tympanum and notes also a number of voluntary and involuntary compensations not visible to the eye. The job of counting swallows is customarily handled by a physician who enters the high-altitude chamber with the prospective flier. But with a device like the Tympanometer there would be no need for the physician to remain in the chamber.

Pieces machined from rods of styrene copolymer serve as insulators for this experimental instrument and provide mechanical strength. Protection for the outside end of the earpiece is offered by a black dust cap machined from Micarta. Both parts are shown in the exploded view (lower). The battery case, composed entirely of Plastacele and made by gluing five sides and sealing the top with small machine screws, can be seen in the view (upper) of the assembled Tympanometer and battery case.

This apparatus, actually a miniature short wave radio set, detects pressure changes on the eardrums by means of fluid-filled chambers placed against the ear of the subject. On one side the fluid rests against the eardrum and on the other against a diaphragm in the microwave transmitter which resembles an earphone. Horn-like projections serve as antennas. The diaphragm, coupled the to eardrum by the liquid, moves a pin within the instrument with each swallow, causing a peak to appear in the transmitted wave which is registered and recorded on a chart outside the chamber. The transmission of these impulses is accomplished by means of telemetering.

ACRYLICS TAKE THEIR RIGHTFUL PLACE in the glittering world of entertainment through the medium of a 10-piece orchestra composed entirely of transparent instruments. The group, which might well be dubbed a "Symphony in Plexiglas," is led and managed, coincidentally, by William Glass, New York musician, who hand fashions the musical pieces from the crystal-clear plastic.

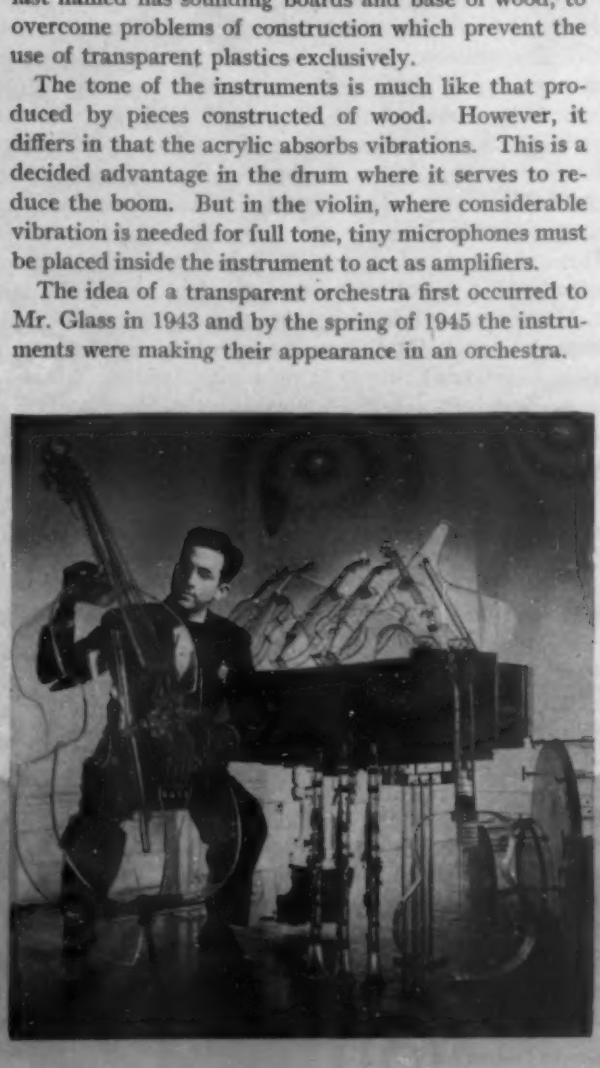
Making the instruments is a family affair with Mr. Glass and his wife performing the major operations in their apartment kitchen—close quarters at best. Much like a dressmaker their first step is to make a pattern.

The acrylic is then cut, heated in an oven and carefully formed to produce the delicate curves required by fine instruments. In the next step the pieces of each instrument are glued together and sanded to remove rough edges. Aside from the buffing machine used to bring the acrylic to a high polish, a sharp cutter and a few simple carpenter's tools are sufficient for the job.

Musical pieces made now include trap and bass drums, violin, bass viol, guitar, clarinet and piano. The last named has sounding boards and base of wood, to overcome problems of construction which prevent the use of transparent plastics exclusively.

The tone of the instruments is much like that produced by pieces constructed of wood. However, it differs in that the acrylic absorbs vibrations. This is a decided advantage in the drum where it serves to reduce the boom. But in the violin, where considerable vibration is needed for full tone, tiny microphones must be placed inside the instrument to act as amplifiers.

The idea of a transparent orchestra first occurred to Mr. Glass in 1943 and by the spring of 1945 the instruments were making their appearance in an orchestra.



PRODUCTS*

A PLASTIC ATTACHMENT FOR TYPEWRITERS is designed to make light work of cutting stencils and to rescue office workers from headaches and the resultant bad dispositions. The major bugaboo of preparing a stencil for the mimeograph machine has always been the dark surface of the impression sheet which does such a remarkable job of camouflaging the letters as they are cut. With the able assistance of Stencilite, produced by Pengad Manufacturing Co., the stencil may be read almost as easily as ordinary typewriting on a white sheet of paper.

Fairly simple in operation, the ingenious device consists of a transparent Lucite cylinder, an oval-shaped Bakelite housing and 25-watt standard electric light bulb. Encased in the phenolic housing the cylinder forms a window through which to view the stencil. The attachment fits over the carriage of the typewriter in such a way as to allow plenty of room for the carriage to revolve freely. When the whole thing is in place the light glows from beneath the wax impression sheet and shows through the tiny cuts made by the typewriter, illuminating each letter. In order to read a letter, word or whole line that has just been cut, the carriage is merely turned until that portion of the stencil is moved into position for reading it through the window.

Plastics were found to be particularly adaptable to this application, which employs no non-plastic materials other than in the electric light bulb and the small screws used in assembly. The light weight of plastics makes the device easier to attach and the transparent window allows for clear vision and yet will not break easily. An especially valuable feature of the device is that it need not be removed after the stencil has been cut as it will not interfere with typing of a general nature. Its use allows the worker to go much faster and thereby saves both time and money for the office, as well as providing for greater efficiency and preventing eyestrain and fatigue.

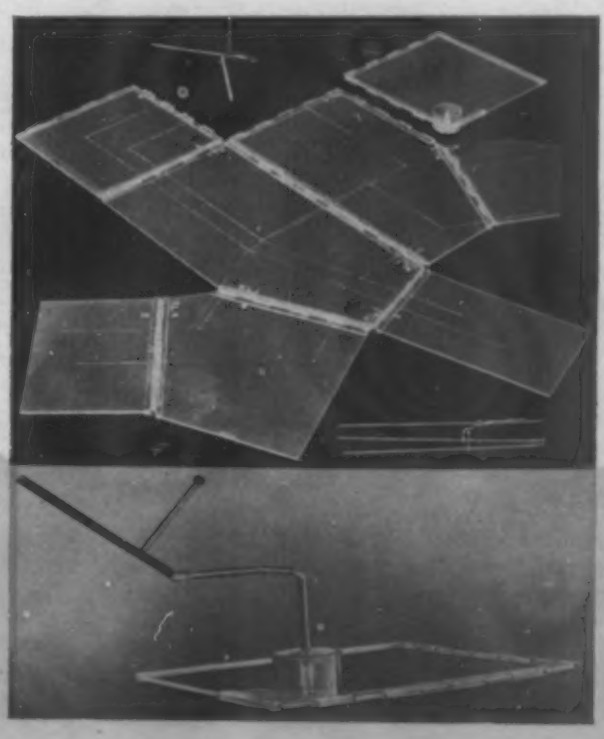
* Reg. U. S. Patent Office.

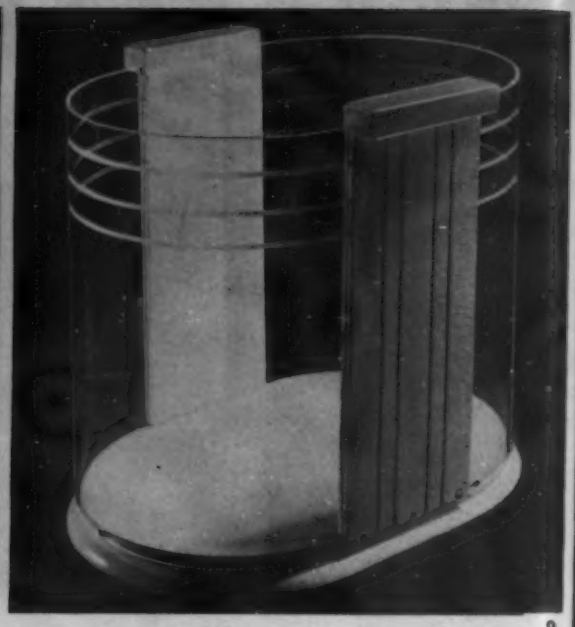
THEORETICAL PROBLEMS IN DESCRIPTIVE geometry which seemed destined to remain far above the heads of Navy V-12 students at Northwestern University were finally brought down to earth by means of transparent Lucite models which made it possible for students to visualize space relationships.

Responsible for this innovation in teaching was Edwin C. Bruno, architect, who was a visiting lecturer at the university at the time. Working with technicians in the university shops, he constructed a model of methyl methacrylate, chosen because it was transparent and had the strength to withstand rough handling. Sections of the model are hinged together, pins for the hinges being plastic knitting needles whose heads make them easy to remove. Joining the component parts of the hinge itself are separate pieces of methyl methacrylate bonded to their respective plane surfaces with acrylic cement.

The teaching difficulties culminating in the making of this model arose from trying to put across a complex branch of geometry to groups of men with widely diversified backgrounds and often little training prerequisite to the course. The model illustrated helped solve an especially difficult problem involving the use of second auxiliary planes, which are not at right angles to the three basic planes of projection. The crux of the problem was the distance between a point and a line running oblique to all three basic planes of projection. When oral explanation proved useless, the instructor turned to the model, clearing up the matter in an hour lecture.

This technique of simplifying the science of descriptive geometry has been successfully applied to the whole field of construction and fabrication by draftsmen, architects and engineers. The new technique can be used for any problem involving, 1) intersection of lines or surfaces, 2) intersection of planes, 3) angles between lines and planes, 4) angles between planes and 5) points created by the intersection of lines and planes.





PHOTOS, COURTESY SUNDBERG & FERAR

1 2

1 and 2—Rushed from the designing board to home furnishing departments, these home accessories set a high standard in the skillful combination of acrylics and wood. Both in the tray and wastepaper basket, wood was selected for the base. The transparent material, on the other hand, was used for the side walls and trim

Acrylics and wood combined

NOT hand work but the assembly line production techniques that kept our Air Forces supplied with blown acrylic and molded phenolic aircraft parts throughout the war are responsible for the varied household accessories pictured on this and the following page. These newly introduced transparent plastic and wood articles are a departure from the usual in more ways than one. Besides being adaptable to mass production, they were designed so that only a minimum of plant retooling was necessary to fit them to the plant's manufacturing facilities.

When Sundberg & Ferar, industrial designers, developed this line for the Plastics Manufacturing Co. they envisioned the production of articles that would fit into any interior decor or color scheme. This adaptability is partly the function of the transparent acrylic sheet, partly that of the many colored woods. Sometimes maple is selected for use with the transparent sheet, again, mahogany or blond wood is employed. But whatever the application—be it the magazine rack, waste basket, cocktail tray, salad service set, ice tongs or serving tray—the wood, and the acrylic too, is used in the sections for which its properties best suit it and where its particular points of beauty will do the most to enhance the finished piece.

Piece by piece

Take as examples the serving tray and the waste paper basket shown in Figs. 1 and 2. An ability to be formed into complicated shapes is inherent in the acrylic sheet. But containers of this kind are achieved in wood only after painstaking machine and hand work. What then is more logical than that the curved sections of these two articles be made of the transparent plastic. The substantial appearance of wood and its greater weight, on the other hand, dictated the use of this second material in the base of both the serving tray and the basket.

Very different is the use of the two basic materials in the basket shown in Fig. 3. In fact, their application is almost the reverse of that previously discussed (Fig. 2). Instead of using wood for the handles, curved sheets of acrylic are employed. And the side walls are composed of two beautifully grained wooden boards. That this transposition is possible is due to the wide variety of interesting and attractive designs worked out by the artists.

It might almost be said that the magazine rack shown in Fig. 4 combines the underlying design features of the two baskets just described. The side walls are transparent but the center board by which the piece is lifted is of blond wood. As in all these accessories the base is of wood. Anyone who has attempted to locate some special magazine that has been carefully tucked into a rack will appreciate the transparent side walls.

Even the steadiest hands have trouble balancing a tray loaded with brimming glasses. Appreciation of this difficulty prompted the designers and manufacturers of these acrylic and wood home accessories to provide supporting fixtures. In the case of both the trays shown on this page (Figs. 5 and 6) holes are cut in the wood and acrylic into which the glasses can be fitted.

For the tray in Fig. 5, the wooden tray section is cut out and then backed up with an understripping. Transparent plastics are at a minimum in this piece, being used in the simple curved handles and for an almost indistinguishable side edging.

Very different is the treatment of both the materials in

the cocktail tray shown in Fig. 6. Again acrylic sheet is used as a side edging—this time on two sides rather than one. But here the similarity in the trays ends. The wooden base is a perfectly unadorned rectangle. It is the transparent plastic in which the holes are cut for the support of the glasses. Another cut-out forms the handle.

From raw materials to finished parts

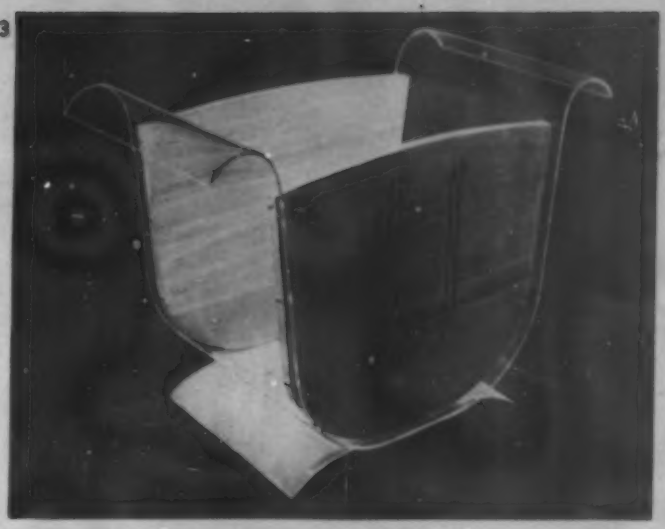
The actual production of the articles is handled by highly skilled workers, each performing one single operation. The acrylic material arrives at the plant in long sheets to be cut and shaped on a special high speed tool. The plastic cut-out is then heated to approximately 240° F. and placed on a forming die where it cools into shape.

Since the acrylic sheet is heated to such a high temperature, it retains its shape indefinitely even should the article be placed near a radiator as it well might be in the home. The plastic cement is used to attach the Plexiglas or Lucite parts to the wood. This eliminates the unsightly fastenings that often mar an otherwise attractive design. When a frosted effect is desired in a piece of acrylic to enhance its decorative charm, the transparent plastic is run lightly over a high speed tool which has been developed specially for this purpose.

Yesterday and tomorrow

It took this plastics company less than five months after the cancellation of its war contracts to get into full production on this entirely new line of civilian goods. Every effort was made to develop products which would enable the plant to make the fullest possible use of techniques developed under the stress of war. Now the designers have been commissioned to work out additional designs for injection and compression molded products. No doubt these will make use of the mass production facilities of the processor as do these acrylic and wood household items.

3



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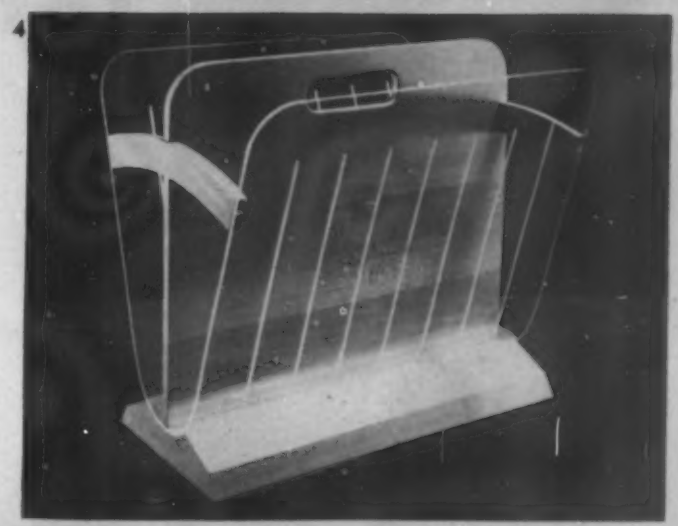
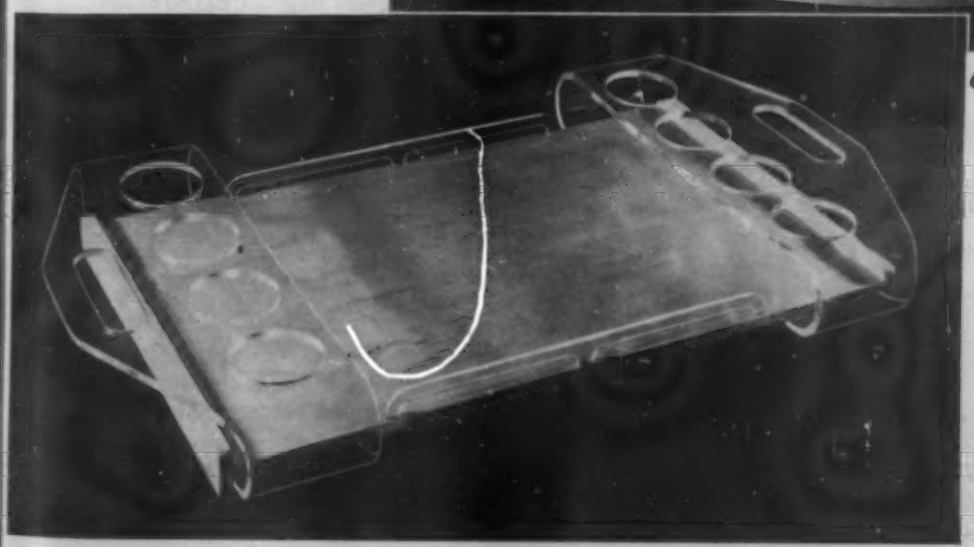


3—In contrast to Fig. 2, the handles of this piece are of acrylic sheet. 4—Mindful of how difficult it is to see the names of magazines once they are in place in a rack, this design uses acrylic sides

5

6



5—The best possible use is made of both acrylic sheet and the fine-grained wood in this cocktail tray

6—Reversing the pattern followed in Fig. 5, the glass holders in this tray are cut from transparent sheet. The base is still machined from light wood

A Flying FUEL TANK

PHOTOS, COURTESY PIPER AIRCRAFT CORP.

The structural use of low-pressure plastic materials in aircraft is under test in the experimental Skycycle (left) whose front fuselage is an adaptation of the big jettison tank used throughout the war on Corsairs (top). These 189-gal. jettison tanks are made from a needled rope manila or sisal fiber blanket impregnated with phenol-formaldehyde resin. Dry powder is used here, being vibrated into the mat to secure a resin content of 51 to 60 percent. After the flat sheets are heated, they are placed over a metal mold, wrapped with cellophane, covered with a rubber blanket and cured in an autoclave

ACROSS the horizon of the private airplane industry three months ago flew the Skycycle, newest projected model in the Piper Aircraft Corp. line and test unit for the structural use of low-pressure phenolics in aircraft. Looking like a glamorous and expensive toy, the new plane is in reality an efficient single-seater machine with a gross weight of less than 830 lb., an empty weight of under 570 lb., a wing spread of 20 ft., a high speed of 115 miles an hour, a cruising speed of 100 and a cruising range of 350 to 400 miles.

The forward section of the fuselage is the key to the plane as an experiment in plastics. It is an adaptation of the F-4-U Corsair belly or jettison tank which is constructed of Co-Ro-Lite. Other plastics are in the hinged Plexiglas bubble-type cabin canopy, and the Sensenich Brothers propeller, which is constructed of either $^{5}/_{8}$- or $^{3}/_{4}$-in. laminated birch boards bonded with resorcin formaldehyde adhesive. In the production of these propellers, pressure is applied through the use of forged "C" clamps. They are kept under pressure for 4 hr. in a temperature and humidity controlled room where the temperature is 110° F.

For the Skycycle fuselage, excepting the tail cone, the big 189-gal. Corsair belly or jettison tank was used. Aluminum reinforcement was added, tail cone and wing fairings riveted on and the top cut off to make the cabin. If the plastic fuselage stands up structurally in use over a reasonable period of time, Piper proposes to build a new mold which would incorporate bulkheads for attaching tail cone and wings. While the plastic is somewhat heavier than tubing and fabric or all-aluminum construction, it is considerably less expensive, it will not tear, dent or buckle on normal impact and, like metal, will not support combustion and will withstand the elements. Monocoque construction gives the fuselage architectural shell strength. This makes for the stability of the airplane when operating at high speeds.

The jettison tank is made from a needled rope manila or sisal fiber blanket which, having no grain, has no delamination tendencies and has uniform strength in all directions. In production, a needling machine serves to drive the top fibers down through the batt, "sewing" it solidly together. Then the rough shapes to make top and bottom halves of the tank are cut out prior to their impregnation with phenol-formaldehyde resin. The dry powder is vibrated into the mat to secure a resin content of 51 to 60 percent. No solvents are required so there is little mess around the plant as there sometimes is if liquids are employed.

The flat impregnated shapes are heated on an endless belt to a point where the resin softens and won't dust out of the fiber. Then they are put in inexpensive preforming molds, drawn to shape and then placed in female curing molds which are made of enameled cast iron or cast aluminum.

Cellophane is placed over the matted material before the assembly is wrapped in a rubber blanket to prevent the rubber from sticking to the molded piece. Then a vacuum of 14 p.s.i. is drawn, and the molds go into an autoclave which is

big enough to hold 6 to 10 of these forms at one time. A vacuum is maintained on the piece while steam pressure of 85 p.s.i., which gives a heat of 320° F., cures the phenolic in a 20-minute cycle.

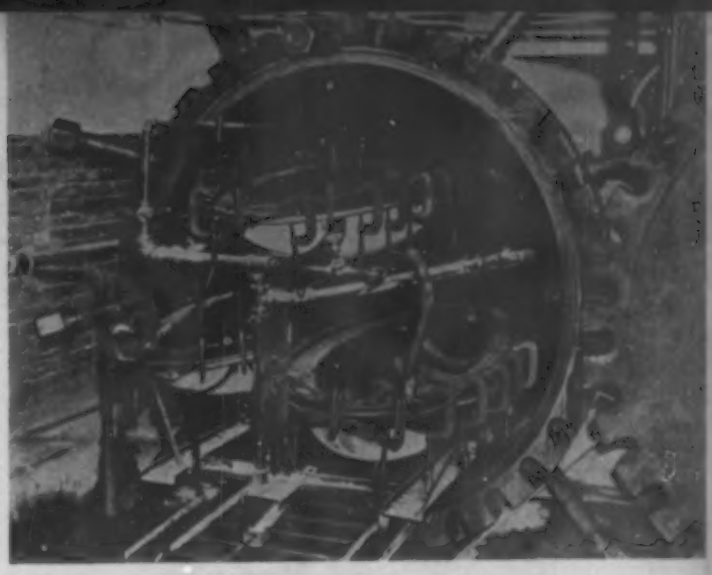
When these molded Co-Ro-Lite shells were being used for jettison tanks, the top and bottom halves of the tank were riveted together, after curing, in a jig. It is likely that these parts would be welded with thermosetting adhesives in regular plane production.

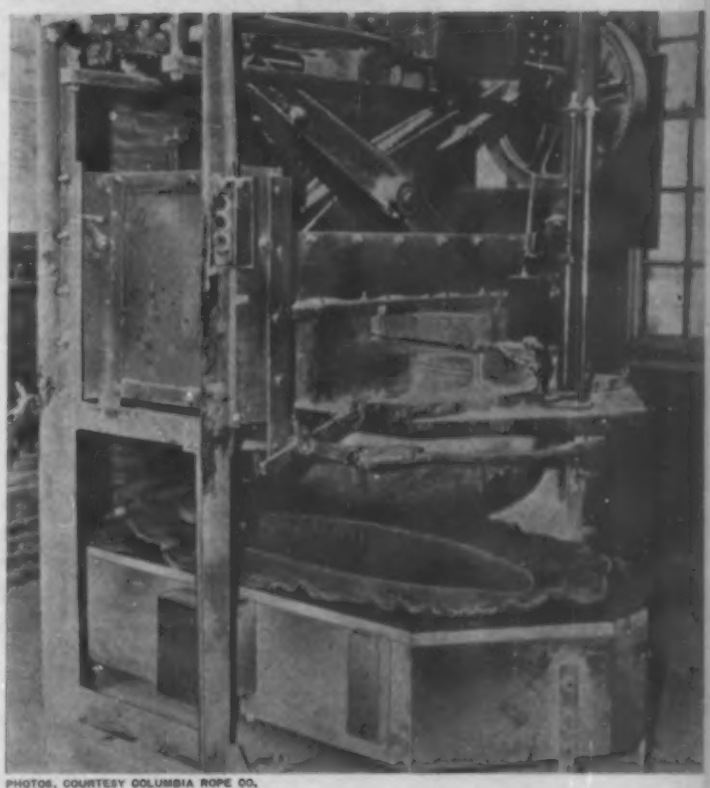
The prototype plane was developed to provide businessmen with a fast, safe and economical means of private transport. It is made to sell for less than $1000, a price made feasible largely by the structural use of plastics which has made possible a reduction in the number of parts in the airframe to a minimum of 300.

Piper Aircraft Corp. stresses the fact that the Skycycle is strictly an experimental job. Only one has been made. But performance and cost records on this unit indicate that it will carry pilot and baggage 350 miles in $3^1/_2$ hr. at a price to compete with other forms of transportation. The present engine is a 55-hp. 4-cylinder, air cooled engine. The blades of the plastic-bonded wooden fixed-pitch propellers are set to give cruising advantage rather than climb.

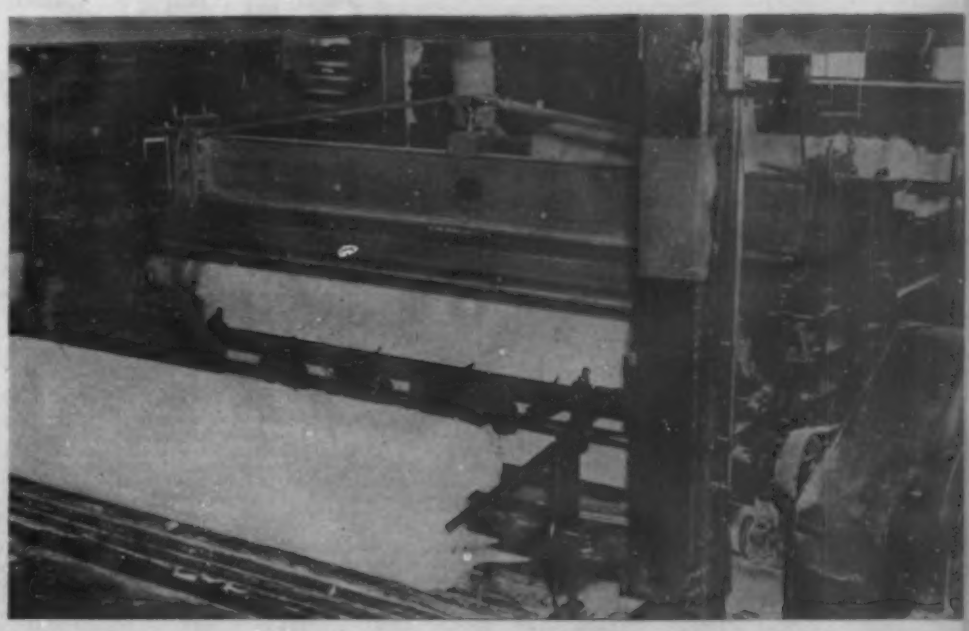
If low-pressure fiber-filled phenolic proves satisfactory in the Skycycle, an enlarged field for its use will be opened. Already canopies, flaps, propellers, instrument panels, upholstery and control apparatus formed of other plastic materials have passed the tests of time. But in this particular airplane the structural use of plastic material is being put to the test.

During the war, many types of fighting aircraft and gliders made use of both fabricated and molded plywood in heavy stressed structural sections. Experimental work at Wright Field has proved that a special type of resin-fiberglas laminate will produce primary structural parts of a plane which are eminently satisfactory. Now, a third material, a phenolic lamination of fiber which, because of the way it stood up to its wartime job in jettison tanks, wing flaps and other places, appeared to be most likely to stand up to structural use in private aircraft. Both the plastics industry and the aircraft industry are watching the Skycycle's performance with considerable interest. It is possible that the test results of this plane's performance will have an effect of the future use of plastics in aircraft.





PHOTOS, COURTESY COLUMBIA ROPE CO.



(Right) The first step in the production of the low-pressure molded jettison tanks involves the "needling" of the sisal blanket when the top fibers are driven down through the batt, sewing it together. The phenolic resin is then sifted into the blanket and the flat impregnated shapes heated to a point where the resin softens. (Center) Here the rough half tank sections are being shaped on wooden molds. (Top) After being transferred to metal molds these tank halves are enveloped in rubber sheets and placed in an autoclave

Statistics on production of plastics

THE output of plastics continued to expand in 1944, compared with previous years, but at a somewhat reduced rate. Production of resins totaled 784 million pounds, or 20 percent more than in 1943. Sales of 696 million pounds were valued at 208 million dollars.

TABLE I.—UNITED STATES PRODUCTION AND SALES OF RESINS, 1940–1944

Year	Production	Sales		
		Quantity	Value	Unit value per lb.
	lb.	lb.	dollars	dollars
1944	784,137,000	695,918,000	207,666,000	0.30
1943	651,511,000	567,567,000	177,991,000	0.31
1942	426,731,106	373,185,293	149,680,000	0.41
1941	437,799,687	348,307,470	117,255,951	0.34
1940	276,814,363	201,099,650	59,368,339	0.30

In 1944, protective coatings led all other uses of synthetic resins, production for this use amounting to 293 million pounds. Nearly one-half of this quantity was phthalic anhydride alkyd resins; the rest was chiefly maleic anhydride and abietic acid alkyd resins. The second largest individual use of resins in 1944 was for molding and casting, which consumed about 120 million pounds. In descending order of importance, the remaining production was for miscellaneous uses and for adhesives, for laminating and for treatment of textiles, paper and leather. Miscellaneous uses, as for glazing, sheeting, films and for ion-exchange, accounted for 205 million pounds.

Among the cyclic resins, phthalic anhydride-glycerol was the most important in terms of quantity and phenol-formaldehyde the most important in terms of value. Among the acyclic resins, the polyvinyl resins were most important, followed by abietic acid and urea-formaldehyde resins. Phthalic anhydride-glycerol and abietic acid resins were used principally

TABLE II.—UNITED STATES PRODUCTION OF CELLULOSE PLASTICS

Year	Cellulose nitrate	Cellulose acetate			Cellulose plastics, total
		Sheets, rods and tubes	Molding compounds	Total	
	lb.	lb.	lb.	lb.	lb.
1st half, 1945[a]	7,555,920	5,506,267	28,849,297	34,355,564	41,911,484
1944	15,950,523	8,279,638	56,746,334	65,025,972	80,976,495
1943	14,042,348	10,163,467	44,222,714	54,386,181	68,428,529
1942	15,128,826	7,453,307	40,792,518	48,245,825	63,374,651
1941	16,499,019	6,218,151	30,716,617	36,934,768	53,433,787
1940	11,915,290	8,887,237	14,962,813	23,850,050	35,765,340

[a] Figures for June were obtained on the basis of consumption, shipments and transfers rather than production, and changes were made in the types of products reported. However, the statistics are approximately comparable with those previously released.

TABLE III.—UNITED STATES PRODUCTION AND SALES OF PLASTIC MATERIALS GROUPED ACCORDING TO USE, 1944

Application	Production		Sales			
	Quantity (net resin content)	Percent of total	Quantity (net resin content)	Value	Percent of total	Unit value per lb.
	1000 lb.		1000 lb.	1000 dollars		dollars
A. Plastic materials, cyclic:						
For molding and casting	72,270	17.9	72,124	26,293	31.6	0.36
For protective coatings	188,678	46.7	173,427	33,274	40.0	0.19
For laminating	50,883	12.6	44,531	9,963	12.0	0.22
For adhesives	26,241	6.5	25,843	5,365	6.4	0.21
For textile, paper and leather treatment	791	0.2	719	203	0.2	0.28
For miscellaneous uses[a]	65,242	16.1	64,169	8,163	9.8	0.13
Total	404,105	100.0	380,813	83,261	100.0	0.22
B. Plastic materials, acyclic:[b]						
For molding and casting	47,645	12.5	38,586	29,279	23.5	0.76
For protective coatings	103,888	27.3	98,487	18,993	15.3	0.19
For laminating	6,059	1.6	5,908	3,490	2.8	0.59
For adhesives	56,134	14.8	47,238	14,532	11.7	0.31
For textile, paper and leather treatment	26,714	7.0	26,722	10,793	8.7	0.40
For miscellaneous uses[a, b, c]	139,592	36.8	98,164	47,318	38.0	0.48
Total	380,032	100.0	315,105	124,405	100.0	0.39

[a] Includes small amount of resin reported for ion exchange.
[b] Includes small amounts of alicyclic and heterocyclic resins.
[c] Data of the total quantity of acyclic resins produced and sold for glazing, sheeting and films have been combined with resins for miscellaneous uses in order to prevent the disclosure of the operations of individual companies.

TABLE IV.—UNITED STATES PRODUCTION AND SALES OF PLASTIC MATERIALS GROUPED ACCORDING TO CHEMICAL COMPOSITION, 1944

Material	Production	Sales[a]		
		Quantity	Value	Unit value per lb.
	1000 lb. (net resin content)[b]	1000 lb. (net resin content)[b]	1000 dollars	dollars
PLASTIC MATERIALS, CYCLIC				
Total	404,105	380,813	83,261	0.22
Condensation resins, benzenoid, total	334,330	311,280	76,031	0.24
Alkyd resins, total	132,397	118,344	22,277	0.19
Saturated polyesters type, total	130,118	116,075	21,812	0.19
Phthalic anhydride-glycerol, total	127,849	114,201	21,391	0.19
For molding and casting	162	118	35	0.30
For protective coatings	127,080	113,531	21,243	0.19
For miscellaneous uses	607	552	113	0.20
Phthalic anhydride, except phthalic anhydride-glycerol type[c]	2,269	1,874	421	0.22
Unsaturated polyesters type: Phthalic anhydride-allyl alcohol type[d]	2,279	2,269	465	0.20
Coal-tar acid resins, total	197,312	188,361	52,659	0.28
Phenolic resins, total	158,944	153,365	42,458	0.28
p-tert-Alkylphenol-aldehyde[e]	2,573	2,511	806	0.32
Cresol-formaldehyde, total	14,825	15,135	3,546	0.23
For laminating	12,481	12,796	2,889	0.23
For miscellaneous uses	2,344	2,339	657	0.28
Phenol-formaldehyde, total	116,203	111,336	33,574	0.30
For molding	42,094	41,868	15,726	0.38
For protective coatings	10,294	10,112	3,792	0.38
For laminating	27,173	23,169	5,527	0.24
For adhesives	21,080	20,787	3,841	0.18
For textile, paper and leather treatment	318	[f]	[f]	...
For miscellaneous uses	15,244	15,400	4,688	0.30
Phenol-formaldehyde, abietic acid modified	2,020	1,625	237	0.15
Phenol-formaldehyde, abietic acid ester modified	20,889	20,627	3,492	0.17
Other phenolic resins	2,434	2,131	803	0.38
Mixed phenolic (tar acid), total	38,368	34,996	10,201	0.29
Cresylic acid-formaldehyde	6,720	4,147	1,089	0.26
Cresols and xylenols-aldehyde	1,740	1,341	385	0.29
Other mixed phenolic resins	29,908	29,508	8,727	0.30
Other cyclic condensation resins	4,621	4,575	1,095	0.24
Polymerization resins, benzenoid, total	69,775	69,533	7,230	0.10
Polyaromatic resins, total	57,919	57,808	6,973	0.12
Styrene resins:				
Polystyrene resins	10,571	10,702	3,001	0.28
Other polyaromatic resins	47,348	47,106	3,972	0.08
Other cyclic polymerization resins	11,856	11,725	257	0.02
PLASTIC MATERIALS, ACYCLIC[g]				
Total	380,032	315,105	124,405	0.39
Condensation resins, total	178,655	165,972	38,232	0.23
Alkyd resins, total	112,685	105,091	17,840	0.17
Abietic acid and abietic acid-maleic acid	78,055	72,046	8,491	0.12
Fumaric acid	3,411	3,306	665	0.20
Maleic acid or anhydride and maleic anhydride-terpene	13,569	12,952	3,163	0.24
All other[h]	17,650	16,787	5,521	0.33
Organic nitrogen resins, total	65,970	60,881	20,392	0.33
Urea-formaldehyde, total	47,972	43,016	13,209	0.31
For molding and casting	18,647	13,958	7,108	0.51
For adhesives	22,411	20,876	4,575	0.22
For textile, paper and leather treatment	3,486	5,265	907	0.17
For miscellaneous uses	3,428	2,917	619	0.21
Other organic nitrogen resins	17,998	17,865	7,183	0.40
Polymerization resins, total	201,377	149,133	86,173	0.58
Allyl and furfuryl alcohol polymerization resins	373	444	394	0.89
Polyvinyl alcohol, ester and halide resins	111,900	91,369	39,743	0.43
Polyvinyl alcohol-aldehyde resins	14,992	11,611	10,489	0.90
Other acyclic polymerization resins[i]	74,112	45,709	35,547	0.78

[r] [a] Sales of resins for protective coatings may include intraplant transfers, i.e., transfers from the producing division of a plant to the division of the same company which consumes the products for the manufacture of paints and varnishes.

[b] Data on production and sales are shown in terms of net resin content, i.e., exclusive of all fillers, drying agents, dyes and plasticizers. Chemical modifiers such as abietic acid and special oils are considered part of the net resin content when they are chemically combined with the principal resin.

[c] Includes phthalic anhydride chemically combined with glycol or pentaerythritol, or pentaerythritol-abietic acid mixtures, or other saturated polyhydric alcohols.

[d] Includes small amounts of unsaturated polyester type of alkyd resin other than phthalic anhydride type.

[e] Includes data for *p*-tert-Amylphenol-formaldehyde and *p*-tert-Butylphenol-formaldehyde resins.

[f] Statistics on the quantity and value of sales of phenol-formaldehyde resins for textile, paper and leather treatment are combined with statistics for phenol-formaldehyde resins for miscellaneous uses in order to prevent the disclosure of the operations of individual producers.

[g] Includes small amounts of alicyclic and heterocyclic resins.

[h] Includes statistics for azelaic, citric, sebacic, succinic acid resins and for Congo ester resin and several other miscellaneous resins.

[i] Includes statistics for polymethacrylic acid ester resins, polyamide resins and several other miscellaneous resins.

TABLE V.—U. S. PRODUCTION AND SALES OF PLASTICIZERS, 1944

Material	Production	Sales		
		Quantity	Value	Unit value per lb.
	1000 lb.	1000 lb.	1000 dollars	dollars
Grand total	179,376	167,821	38,662	0.23
PLASTICIZERS, CYCLIC				
Total	152,866	149,200	31,854	0.21
Phosphoric acid esters:				
Tricresyl phosphate	21,172	20,409	4,979	0.24
Phthalic acid or anhydride esters, total	116,810	114,715	22,091	0.19
Dibutyl phthalate	47,810	47,232	9,533	0.20
Diethyl phthalate	3,478	3,714	710	0.19
Dimethyl phthalate[a]	42,837	42,163	6,609	0.16
All other	23,685	21,606	5,239	0.24
All other	14,884	14,076	4,784	0.34
PLASTICIZERS, ACYCLIC				
Total	26,510	18,621	6,808	0.37
Lauric acid esters	946	927	354	0.38
Oleic acid esters	3,544	2,049	431	0.21
Phosphoric acid esters	1,104	1,085	452	0.42
Sebacic acid esters:				
Dibutyl sebacate	5,455	4,522	2,216	0.49
Stearic acid esters, total	2,966	2,622	825	0.32
Butyl stearate	602	591	175	0.30
Glyceryl monostearate	1,260	958	322	0.34
All other	1,104	1,073	328	0.31
All other	12,495	7,416	2,530	0.34

[a] Includes dimethyl phthalate for use as an insect-repellent.

for protective coatings; phenol-formaldehyde for molding and casting; urea-formaldehyde for adhesives; and polyvinyl resins for a variety of uses including molding and casting, treatment of textiles, paper and leather, and the production of adhesives and elastomers.

The acyclic resins showed the principal gain in the output of resins in 1944. Production rose to 380 million pounds in 1944 from 273 million in 1943. The increase was principally in the abietic-acid type of alkyd resins, and polyvinyl polymerization resins.

Synthetic elastomers, as defined in this report, not only include synthetic rubber of the GR-S, GR-A, Thiokol, butyl and polychloroprene (Neoprene) types for special purposes and for tire manufacture, but also the elastomers derived from polyethylene, polyvinyl alcohol, polyvinyl chloride, polyvinylidene chloride and similar materials. The relative importance of this group has grown with the importance of synthetic rubber to the Nation. Production of cyclic synthetic elastomers, chiefly the butadiene-styrene types, reached 1.5 billion pounds in 1944, an increase of 263 percent over the output of 414 million pounds in 1943. Production of acyclic elastomers, chiefly the Neoprene and butadiene acrylonitrile types, rose to 262 million pounds in 1944 from 159 million in 1943. In 1944, the average unit value of sales of cyclic elastomers was 19 cents per pound and of the acyclic type, 38 cents per pound. The total value of sales of all these different elastomers in the year 1944 was reported as being 358 million dollars.

The data in Table II for production of cellulose plastics are based on figures released by the Bureau of the Census, Department of Commerce. Tables I, III, IV, V and VI, are based on statistics obtained and compiled by the United States Tariff Commission. Table I and III appear on page 134; Table IV on page 135.

TABLE VI.—UNITED STATES PRODUCTION AND SALES OF ELASTOMERS,[a] 1944

Material	Production	Sales[b]		
		Quantity	Value	Unit value per lb.
	1000 lb.	1000 lb.	1000 dollars	dollars
Grand total	1,763,227	1,633,500	357,769	0.22
ELASTOMERS, CYCLIC				
Total	1,500,993	1,395,136	268,315	0.19
Polybutadiene-styrene (GR-S type):				
Produced at Government plants[c]	1,497,758	1,391,697	266,961	0.19
Produced at private plants[d]	3,235	3,439	1,354	0.39
ELASTOMERS, ACYCLIC				
Total	262,234	238,364	89,454	0.38
Polybutadiene-acrylonitrile (GR-A type):				
Produced at Government plants	4,617	46	23	0.49
Produced at private plants	33,114	31,658	14,931	0.47
Polychloroprene (GR-M type)[e]	105,957	98,435	27,070	0.28
Polyisobutylene-diolefin (GR-I type)[f]	42,315	34,362	8,857	0.26
Polyisoprene[e]	370	366	68	0.18
All other[g]	75,861	73,497	38,505	0.52

[a] An elastomer is defined as a material which will stretch repeatedly to 150 percent or more and will return rapidly and with force to its approximate original shape. Synthetic elastomers include synthetic rubbers.

[b] Value of sales for plants operated for the Rubber Reserve Company represent in some instances the value calculated from the quantity of sales and the average book value per pound for 1944 as supplied by the Rubber Reserve Company.

[c] In addition, plants operated for Polymer Corp., a Canadian government corporation, produced 71,814,400 lb. and sold 71,814,400 lb. valued at $13,285,664.

[d] Includes statistics for polystyrene and polyisoprene-styrene elastomers.

[e] Data for Government plants only.

[f] In addition, plants operated for Polymer Corporation, a Canadian government corporation, produced 6,198,080 pounds and sold 6,198,080 pounds valued at $960,702.

[g] "All other" includes statistics for some of the plastic materials reported in Table IV which have been converted by plasticizing into elastomers, such as polyvinyl chloride-acetate copolymer, polyvinyl alcohol and polyvinyl alcohol-aldehyde elastomers. Also includes statistics for polyalkylene sulfide elastomers, polychloroprene elastomers, polymerised rubber chloride and hydrochloride, polyethylene and polyisobutylene elastomers produced in private plants.

Time and temperature control for compression molding

by ARTHUR HERMANN†

TO understand the more complicated methods of plastics processing, the control systems which operate these processes should be studied and their operating requirements thoroughly understood.

Elements of Hydraulic Control Systems

Press closure using single valve

In the compression molding field, platen presses take many different forms. However, it is well to start with the simplest type of compression molding press—one with two platens.

Compression-type molding presses depend upon some form of hydraulic fluid for their operation. This hydraulic fluid may be either water or oil. In many of the large plastic molding plants, an accumulator-type hydraulic fluid system is used for the operation of the platen presses. This is the type of control system that will be discussed in this article, and illustrated by various diagrams.

Many of the newer platen presses are equipped with self-contained pump systems to provide both high- and low-pressure hydraulic fluid for the operation of the molding press. Most of the data to be given will apply equally well to compression presses utilizing either the accumulator or the self-contained pump system. One of the major differences between these two is in the type of valve which is used in the hydraulic line. In the accumulator system, pneumatically operated diaphragm valves are used. In the self-contained pump system, either solenoid valves or diaphragm valves may be employed.

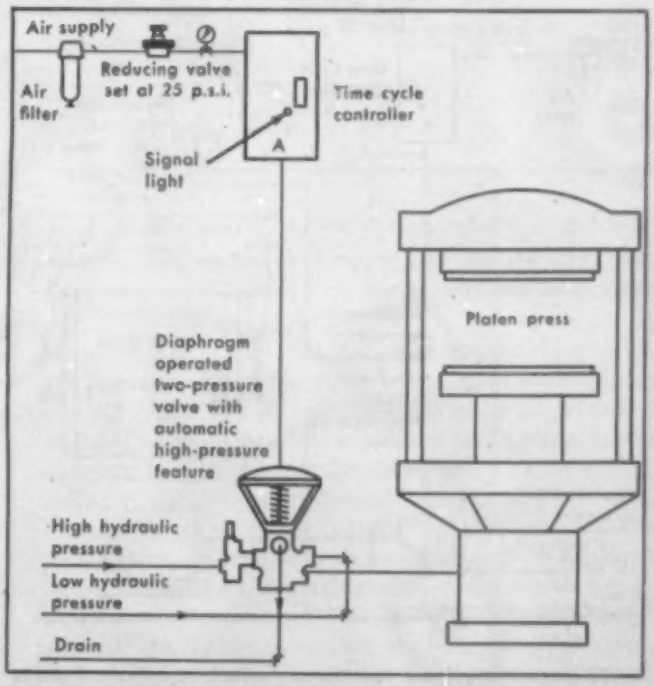
Application drawings and references in the text to time-cycle controllers apply specifically to the Taylor Flex-O-Timer. This instrument is a fully adjustable time-cycle controller which regulates the sequence and duration of operations in the molding of plastics. Changes in timing for various types of products are accomplished by the positioning of a series of trip pins on a revolving drum. The trip pins actuate either electric switches or pneumatic valves or combinations of both, so that from the time the operator presses the starting button until the opening of the press, all functions of the molding operation are completely automatic.

Figure 1 shows the equipment required for closing a simple compression-type molding press. This scheme utilizes a two-pressure hydraulic valve with an automatic high-pressure feature. When the controller is started by means of a push button (not shown), air pressure is applied to the diaphragm top of the two-pressure valve. This admits a large volume of low-pressure fluid to move the lower platen of the press to its closing position. As soon as the platens come together, the automatic high-pressure valve which is part of the two-pressure valve, functions on a pressure basis to automatically admit higher-pressure fluid to the press. Only a small volume of this fluid is required.

At the end of the process cycle, the timer removes the air pressure from the diaphragm top, and permits the hydraulic fluid trapped below the ram cylinder to flow through the valve to the drain, or back to a sump.

Figure 1 represents the simplest of the press closure schemes for a compression-type molding press. If a self-con-

ALL DRAWINGS, COURTESY TAYLOR INSTRUMENT COMPANIES



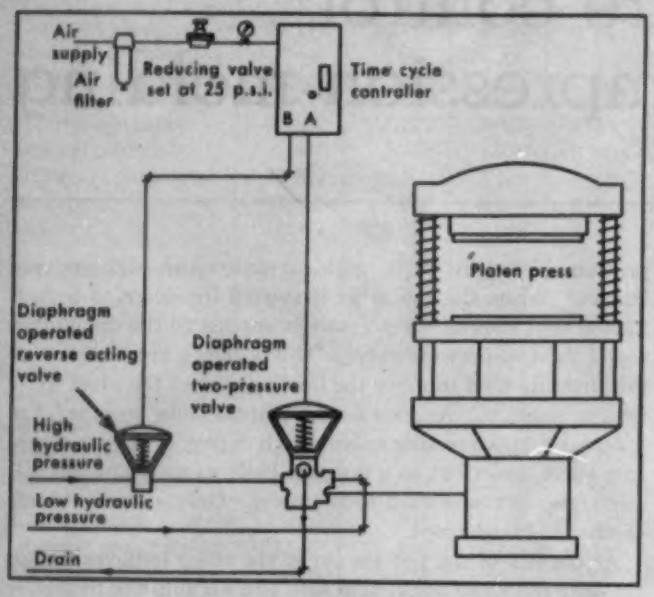
1—This simple type of automatic press closure system controls the drain as well as high and low pressure

* Reg. U.S. Patent Office.
† Application Engineering Dept., Taylor Instrument Companies.

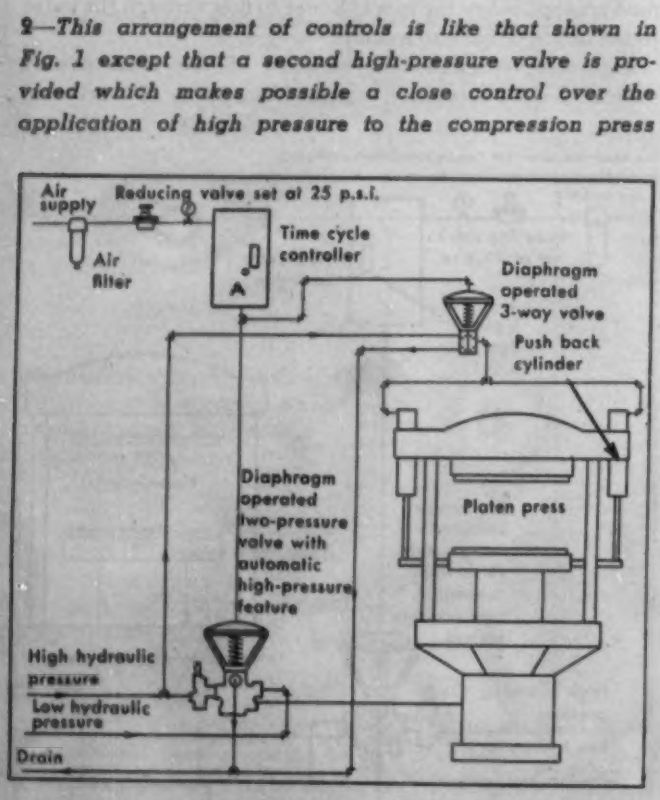
tained pump system were utilized, a solenoid-operated valve could be used. This would call for an electrical function to appear in the timer rather than a pneumatic function.

Press closure using two valves

Quite often in the molding of plastic items, it is of importance that the admission of the high-pressure fluid be delayed after the initial closing of the press. Where this is necessary, the two-pressure hydraulic valve with automatic high-pressure feature is not used. A separate high-pressure hydraulic valve is introduced in the high-pressure line. A two-pressure valve is also used, but without the automatic high-pressure feature. This scheme is carefully detailed in Fig. 2.



2—This arrangement of controls is like that shown in Fig. 1 except that a second high-pressure valve is provided which makes possible a close control over the application of high pressure to the compression press



3—This set-up allows for the automatic control of press closure and the automatic application of pressure to the push-back cylinders which aid in opening the press

The process cycle is started by the depression of the start button as before. Air pressure is then immediately applied to the two-pressure valve by a pneumatic function of the controller labeled *A*. This causes the press to close under low pressure. After a predetermined length of time, a second pneumatic function in the timer, labeled *B*, operates to apply air pressure to the reverse-acting diaphragm-operated valve in the high-pressure line. Air pressure applied to the reverse-acting valve admits high-pressure fluid to the ram cylinder of the press. At the close of the process cycle, air pressure is relieved from both valves, the fluid drains from the ram cylinder and the press opens. The time cycle controller stops at the starting position, in preparation for next cycle.

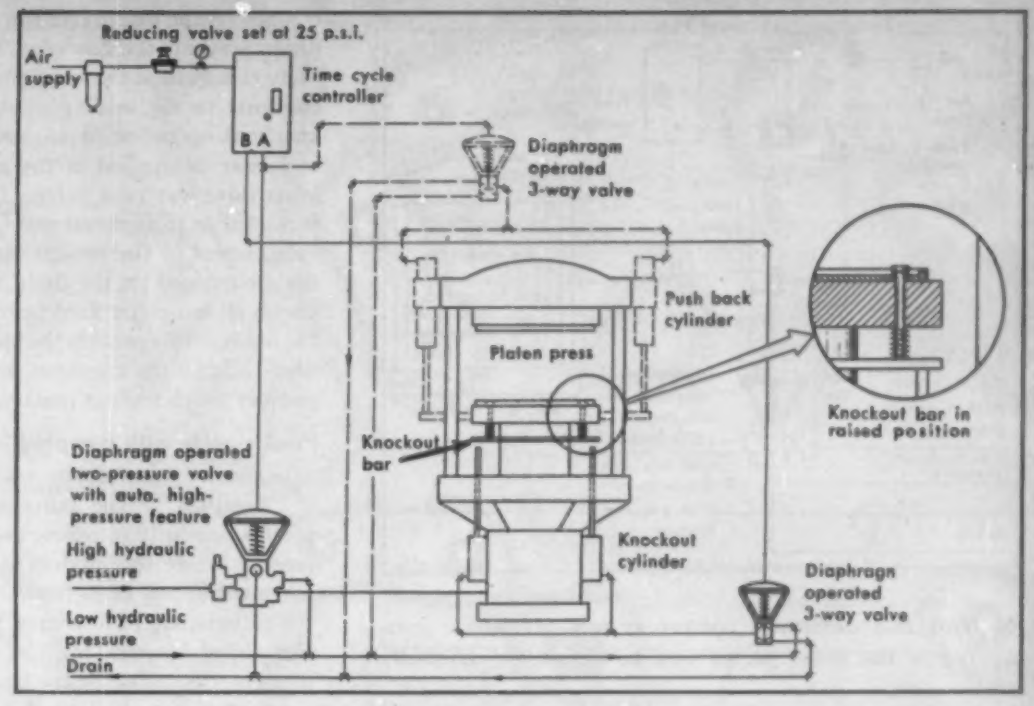
Press closure using pull backs or push backs

The above-mentioned control hook-ups for the closure of a compression-type molding press are to be found in most applications. In addition to the closing of the press, many other operations or features are required. One of these, quite commonly found in compression molding, is the addition of push backs or pull backs. Regardless of which of the two are used, their function is the same: to assist in opening the press. The push back or pull back cylinders are applied to the lower platen to assist the ram in its downward-movement. Figure 3 illustrates a control scheme for closing a compression-type molding press and for operating the push back cylinders. Notice that the push back cylinders actually push downward to assist the press in opening. If pull back cylinders are used, they will normally be found below the platen and pull it downward during the opening operation.

Quite often in compression molding where very large diameter ram cylinders are used, the frictional forces and the adhesive characteristics of the plastic material are such that it is impossible to have the press open by gravity alone. When this is true, some means of assisting the press in opening is required. This is the service of the push back and pull back cylinders. However, in many of the conventional presses the lower platen is spring loaded to assist in the opening operation, and in some of the newer style presses, it is possible to eliminate the push back and pull back cylinders by applying pressure to the upper annular space on the ram cylinder. This, of course, provides the same effect as push back or pull back cylinders.

Referring to Fig. 3, the cycle of operation is started, as before, by the depression of the start button. Immediately thereafter, air pressure is applied to the two-pressure valve to cause the lower platen to move upward. At the same time air pressure is applied to the three-way valve in the high-pressure hydraulic line leading to the two push back cylinders. With the application of air pressure to the three-way valve, the cylinders are free to drain the hydraulic fluid back either to a drain or to the sump. At the completion of the process cycle, air pressure is relieved from both valves to cause the lower platen of the press to move downward. The release of air pressure from the two-pressure valve drains hydraulic fluid from the under side of the ram cylinder. The release of air pressure from the three-way valve admits high-pressure hydraulic fluid to push back cylinders to assist press opening.

Quite often, where rapid operation of the two-pressure valve is required and where the diaphragm top on the two-pressure valve is large, it is necessary to introduce an auxiliary three-way pilot valve which is placed very close to the diaphragm top. The purpose of the three-way valve is to provide air pressure at higher capacity than would ordinarily be obtainable through the pneumatic function in the timer.



4—Layout for automatically closing and opening press through aid of push backs and, finally, automatically operating hydraulic cylinders connected to knock-out bars

This permits the valve to operate much more rapidly than would be possible with the timer valve alone.

Press closure using knockout or stripping cylinders

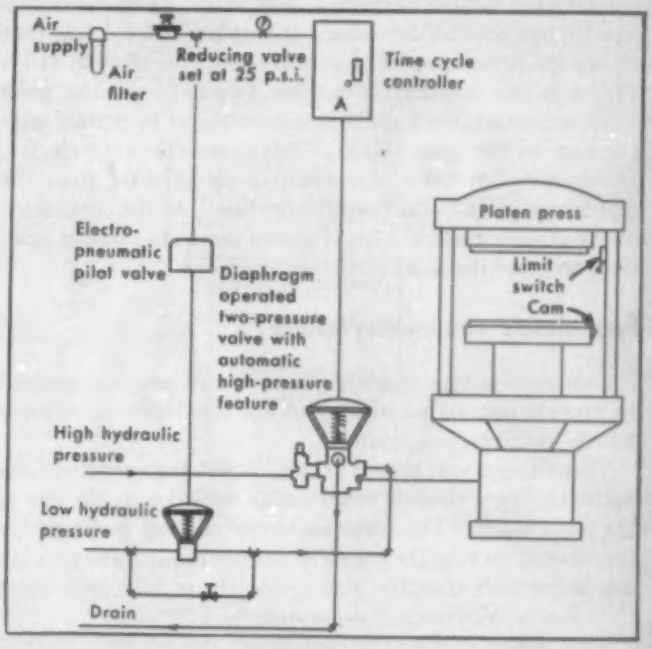
In some types of pressure molding work the compression molding press is equipped with knockout or stripping devices. These are designed to remove the product from the mold at the completion of the process cycle. Figure 4 is a diagram of typical compression molding press equipped with knockout cylinders. Stripping cylinders are applied in a similar manner, but are more commonly located at the top of the press to operate stripping rings in the upper mold. Push back cylinders are shown in phantom lines. For the sake of simplicity the push back cylinders are omitted in subsequent drawings.

As previously described, the process cycle is started by the depression of a momentary contact start button. This permits the time cycle controller to first apply air pressure to the two-pressure hydraulic valve for the closing operation of the press. At the completion of the molding cycle, air pressure is removed from the two-pressure hydraulic valve so that the press can open. After the press has fully opened, air pressure is relieved from another function in the time cycle controller to operate a three-way valve in the low-pressure hydraulic line to the knockout cylinders. This causes the piston rods of the knockout cylinders to move upward to eject the product from the mold. Having accomplished this, air pressure is removed from the three-way valve so that the knockout bar can return to normal. At this point, the process cycle is completed, and the time cycle controller stops.

Press closure with slow-closing feature

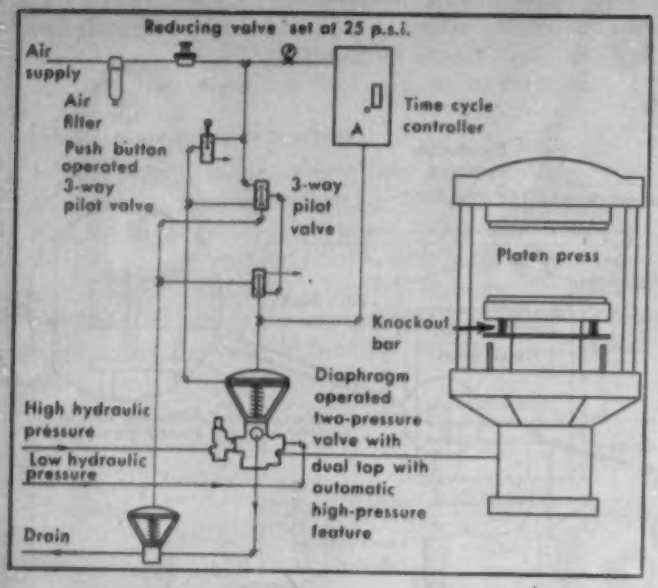
Another feature sometimes found in compression type presses is that of slow-closing. This feature is of particular importance where the mold cavity is quite deep, and the mold is designed for deep recesses in the product. By reducing the speed of press closure at the point of engagement of the pellet with the upper mold cavity, it is possible to eliminate the danger of the pellet being shattered or the fragile portions of the mold damaged.

A compression-type molding press with the slow-closing feature is shown in Fig. 5. It will be noted that in this application, a limit switch is used to detect the point at which the slow-closing is to begin. It is important from the standpoint of production that the lower platen of the press be run at as high a speed as practical until the lower platen is within a certain fixed distance of the closed position. At this point the limit switch restricts flow of fluid to ram cylinder.



5—A simple press closure system which is capable of slowing the speed of closure just as the pressure is beginning to be exerted on the plastic molding material

Again the process cycle is started by the depression of the start button. The time cycle controller applies air pressure to the two-pressure hydraulic valve, which admits low-pressure fluid to the ram cylinder, causing the platen to move upward. As the platen contacts the limit switch, the electro-pneumatic pilot valve is energized. It applies air pressure to the normally open or direct-acting valve in the low-pressure line. As the valve in the low-pressure line closes, the flow of



6—With this automatic control system the exact positioning of the lower platen can be controlled manually

low-pressure fluid is permitted only through the restriction in a by-pass around the valve. It is this restricted flow that causes the press to move at a slower speed, as the two molds approach one another. After the two molds of the press come in contact, the limit switch is no longer in contact with the cam on the lower platen. This de-energizes the electro-pneumatic pilot valve and removes air pressure from the diaphragm valve in the low-pressure line. At the completion of the process cycle, the lower platen moves to its open position, and the time cycle controller stops.

Press closure with inching feature

Compression-type molding presses are sometimes equipped to provide manual positioning of the lower platen. This is known as the inching feature.

This arrangement is used in custom molding operations, for example, where there is considerable variation in the size of the hand molds. The variation in size of these molds makes it necessary to stop the platen in various positions so that the molds can slide from the platen onto the parallel bars where they can be conveniently separated.

This feature is also of advantage in cases where it is necessary to position the lower platen at the height of a loading platform and variations in fluid pressure make it impractical to accomplish this automatically.

Figure 6 illustrates a typical application of the latter type. At the start of the process cycle the time cycle controller functions much the same as in the systems previously described. The major difference occurs, however, at the end of the cycle—after the lower platen has contacted the knockout pins to eject the product. At this point, the time cycle controller has completed its functions and has come to a stopped position. To raise the lower platen, it is only necessary to momentarily depress the pneumatic inching button. This allows air pressure to flow to the dual top on the two-pressure valve and also to the diaphragm top of the normally open or direct-acting valve in the drain line. So long as the air push button is held down, hydraulic fluid is admitted to the ram cylinder, causing the ram or lower platen to move upward. However, as the air push button is released, there is no outflow of hydraulic fluid, since the air pressure is trapped on the diaphragm top of the drain valve. This condition prevents the flow of all fluid from the ram cylinder.

By this method the lower platen may be raised in small increments to the loading position. Should a repeat of the knockout operation be required, a three-way manual stopcock may be applied in the air line to the plunger of the lower three-way pilot valve. By manipulating this stopcock, it is possible to apply air pressure to the plunger of the valve, independent of the two-pressure valve. When this is done, the air trapped on the drain valve is released to the atmosphere, allowing the fluid below the ram cylinder to flow to the drain. This permits the lower platen of the press to again drop back on the knockout pins to eject that portion of the product which was not previously removed.

Press closure with bumping feature

In many types of plastic molding, the press must be bumped or "breathed." The purpose of bumping or breathing a press is primarily to relieve any entrapped gases that may be present before the product is fully molded. Failure to remove entrapped gases from a product causes imperfections.

The bumping of a compression molding press may be accomplished by relieving the pressure on the ram cylinder momentarily to release the trapped gases. This may be done either on a time basis, a distance basis or a pressure basis. The particular application requirements generally determine the type of bumping to be used.

Bumping on a time basis is by far the most common method, and the control system shown in Fig. 1 may be used. Wherever bumping is done on a time basis, it is important that some provision be made in the timer to permit it to be run at a relatively high speed so as to obtain the type of bump that is needed. In other words, the character of a bump may differ from one application to another. In some cases, it is essential that there be a very definite separation of the two molds; in others, all that is necessary is a momentary relief of pressure from the platens. The advantage of having a timer which has a fast operation is that it assures that the bumping can be done according to the application requirements.

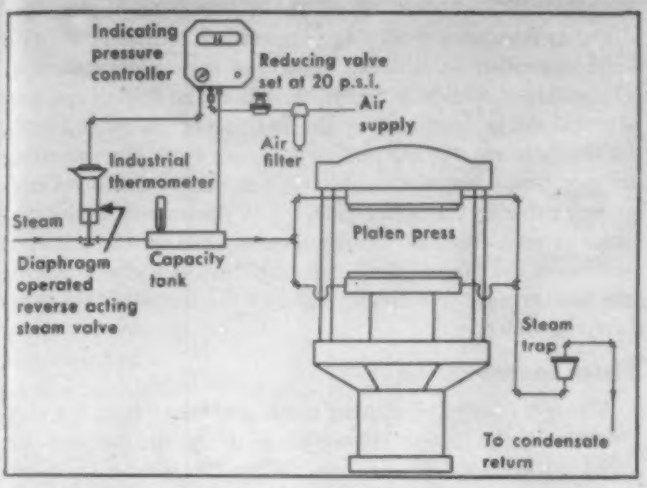
Time cycle controllers having an auxiliary timing mechanism incorporated within their case usually provide a very suitable answer to those applications requiring bumping. With this form of instrument, it is possible to have the time cycle controller drive mechanism run relatively fast, while the auxiliary timing mechanism provides the long time interval for the holding. This form of timer works out very successfully where the time cycle controller can initiate and terminate all of the process functions, and the auxiliary timing mechanism serves only to time the curing or molding period. Another advantage to be gained from this type of time cycle controller, is that the one period in the process cycle which is most frequently changed (usually the molding or curing period) can be adjusted directly on the auxiliary timer without affecting any of the settings on the time cycle controller.

Elements of Temperature Control System

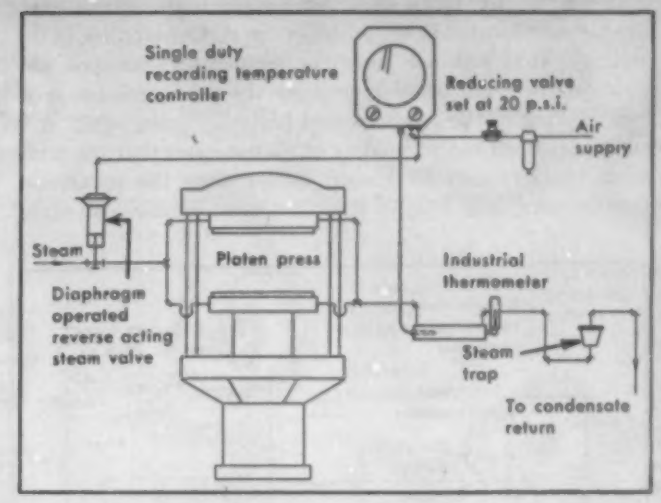
The accurate control of temperature, pressure and time are essential to the production of plastic products of high quality. It is important then, that the main elements of temperature control be given first consideration. Details of the actual control systems may then be reviewed.

Three factors of prime importance to the temperature control of compression molding presses are:

1. The size of the steam control valve.
2. Heat distribution to the platens.
3. Condensate removal.



7—Control of temperature of the steam platens is effected in this set-up by automatic control of inlet steam



8—Here the temperature of the platens is controlled by a temperature sensitive element in the condensate line

While the steam valve must be large enough to allow the several platens of a press to come to temperature quickly, it cannot be over-size without the sacrifice of good control. Where actual steam requirements in pounds per hour are known, the valve may be sized accurately from suitable tables. When such data cannot be supplied it is safer to keep the valve on the small side.

While heat distribution is not a function of the actual controller application, it plays an important part in all press work. Proper manifolding of the steam supply to provide a uniform feed to each platen is a prime consideration.

Condensate removal affects the whole press operation and is tied up closely with heat distribution. This is particularly true in the multi-platen press and should be given special attention in large presses of this type. Steam traps of various forms are available for condensate removal.

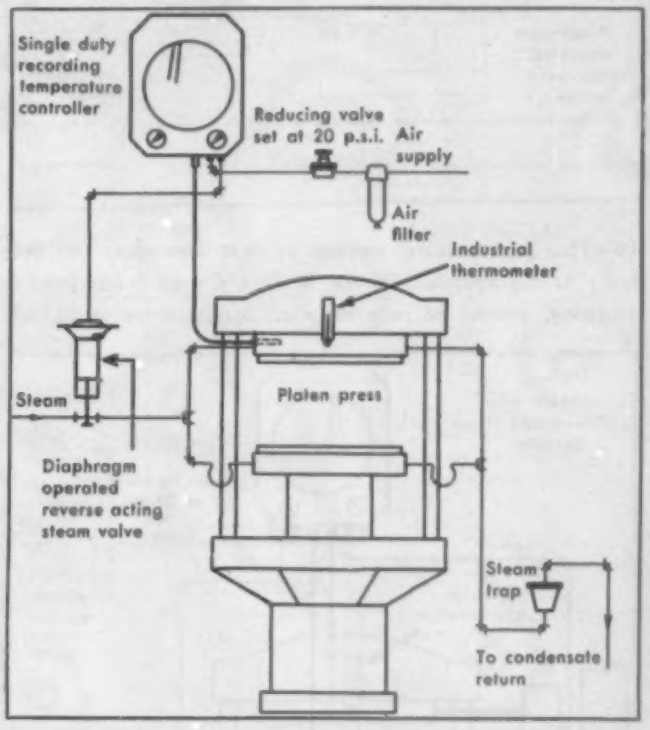
However, in stubborn cases, where the tendency is to by-pass the trap and thus waste large amounts of steam, another device might better be considered. This is the single function or repeating cycle timer. While use of such an element may result in greater steam consumption than is the case with an efficiently operating trap, it will save steam compared to an open by-pass or fixed orifice. The frequent and complete opening of the valve on the condensate line really purges the platens. Any chance for collection of condensate or air pockets is almost completely eliminated. In this way a repeating cycle timer can be of material help in the smoothing out of platen temperatures.

Inlet control—pressure basis

The temperature of the mold is almost universally controlled by the amount of steam pressure which is indicated by the gage. This system is generally quite satisfactory for the average job, but where more precise control is required to give the highest quality product, one of the systems outlined below may be used to advantage.

Figure 7 shows a system of controlling the platens of a compression molding press by controlling the steam pressure on the inlet side of the press. It will be assumed, unless otherwise stated, that the molds are bolted to the steam-heated platen, and the platens will be heated by steam rather than hot water, which is also quite commonly used.

The function of the indicating pressure controller illustrated in Fig. 7, is to modulate the normally closed, or reverse-acting valve in the steam line to maintain a given pressure in the capacity chamber, as determined by the setting of the instrument. The purpose of the industrial thermometer also located in the capacity tank, is to provide a check against the indicating pressure controller. This scheme assumes that saturated steam is available. The condensate from the steam-heated platens is removed by a trap. If it is important that a record be obtained for each process cycle, then a recording pressure controller should be used.



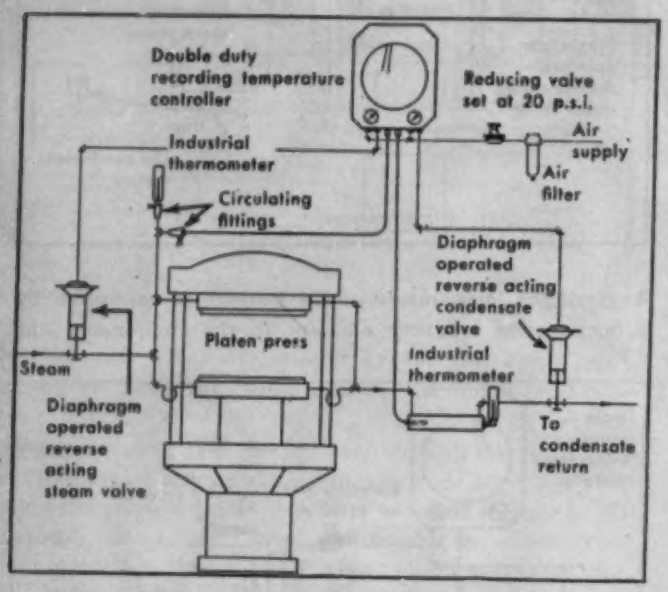
9—In this temperature control system the temperature sensitive bulb is located directly in the mold proper. This type of control system is eminently satisfactory when the mold itself is cored in with the heating medium

Outlet or condensate control

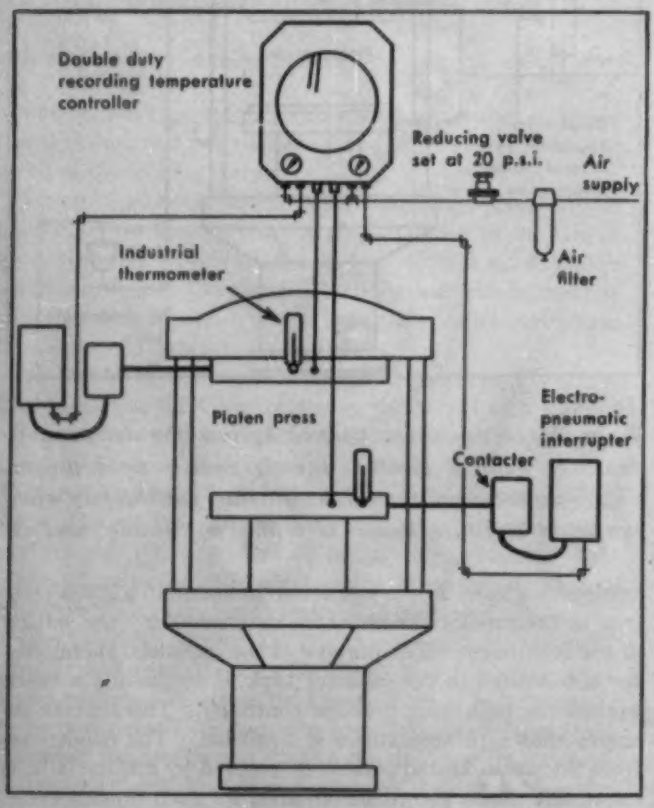
Another method of controlling the steam-heated platens in a compression molding press is illustrated in Fig. 8. This

control system is based upon having the temperature-sensitive element located in the outlet or the condensate line of the platens. It is justified, since the temperature-sensitive element in the condensate represents the minimum temperature existing in the steam-heated platens. Quite often, it is more important in the molding of plastic items that the minimum temperatures be known rather than the maximum. Furthermore, it is usually true that most plastics can stand an over-cure, whereas they cannot stand an under-cure.

Figure 8 shows a recording temperature controller with its bulb located in an enlarged section of the condensate pipe. The enlarged section is provided so that the flow of condensate will not be restricted by the addition of the control bulb. In this scheme, the output air pressure from the recording temperature controller modulates a normally closed reverse-acting valve in the steam line. Also illustrated in the diagram is an industrial thermometer located in the enlarged section of the pipe in the condensate line as a check against the temperature sensitive element of the recording temperature controller.



10—*This temperature control system combines the features of the systems shown in Figs. 8 and 9 but has, in addition, means of recording all temperature variations*



11—*In this temperature control set-up for electrically heated mold elements, temperature sensitive elements are placed directly in the mold itself, accurately controlling the temperature of both force plugs and cavities*

Platen control—steam

Figure 9 illustrates another method of controlling the temperature of the platen. However, in this particular case, the mold and steam platen are one. When this is true, and when the steam passages within the platen are adequate, the temperature sensitive bulb may be located directly in the steam platen or mold. The temperature sensitive bulb should be located in the middle—preferably between two cored passages within the platen. If possible, an industrial thermometer should be located as close to this point as possible so as to provide a check on the recording thermometer.

The control system illustrated in Fig. 9 is quite similar to those previously presented except for the fact that the temperature sensitive element is located in the mold or platen. The output air pressure from the recording temperature controller operates a normally closed or reverse-acting type valve in the steam inlet line. The condensate is removed by a conventional steam trap.

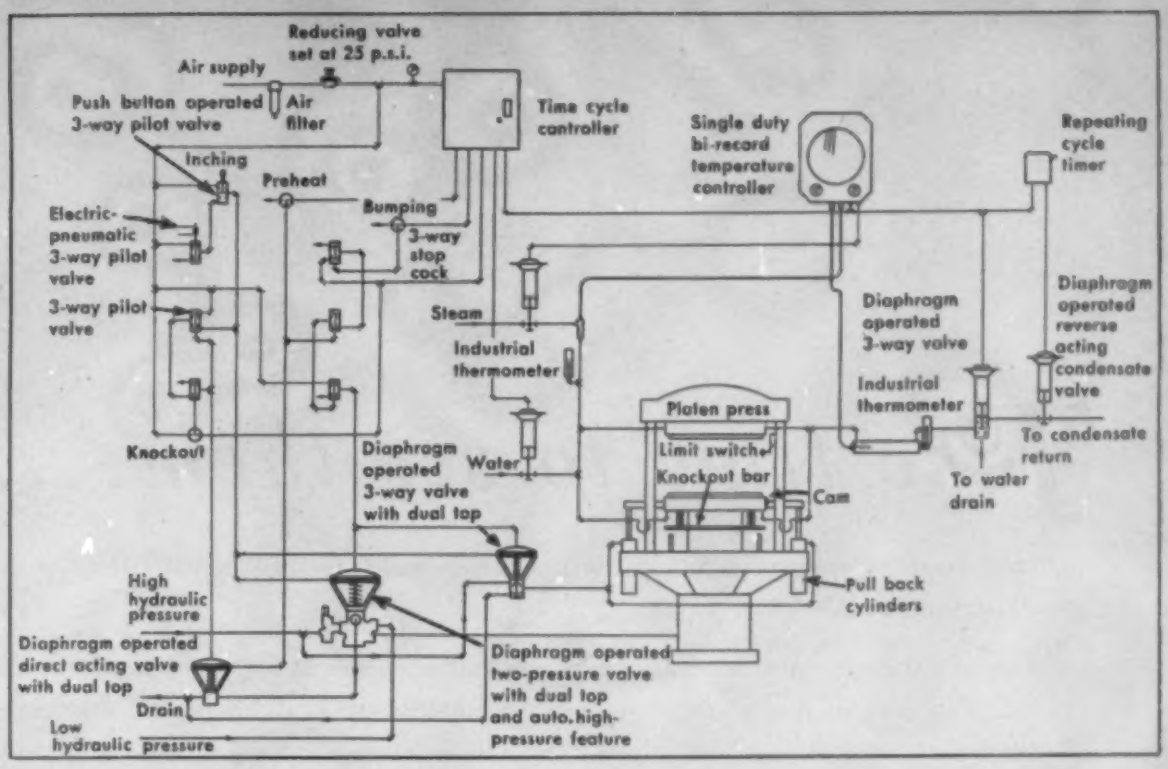
Combined inlet and outlet control

Figure 10 illustrates a typical application control system, which is a combination of two of the previously outlined schemes. This control system utilizes a double-duty recording temperature controller. The inlet steam temperature is controlled by the left-hand control mechanism of the temperature controller. The temperature-sensitive bulb is located in the steam circulating pocket in the inlet line. Another circulating pocket is located close to the one containing the temperature sensitive bulb. This pocket accommodates the industrial thermometer which is used as a check against the recording thermometer. The output air pressure from the left-hand side of the temperature controller modulates the normally closed or reverse-acting valve in the steam inlet line. The right-hand control mechanism of the recording temperature controller serves to control the condensate temperature from the steam-heated platens. The condensate temperature bulb is located in an enlargement in the condensate pipe. The output air pressure from the condensate control side of the controller modulates a normally closed or reverse-acting type valve in the condensate line.

This type of control system provides a definite record of inlet conditions in the two platens during the process cycle. Where very precise control is required by the product, it is sometimes necessary to recommend individual temperature controls to platens.

Platen control—electrical

Illustrated in Fig. 11 is an application drawing for an electrically-heated press, where the molds and platens are made as one unit. In this particular scheme, the temperature-sensitive bulbs are located in each of the two platens. An air-operated controller of the recording double-duty type is utilized. This pneumatically operated controller transmits



12—A typical coordinated control system which includes many of the features described previously

an output air pressure to an electro-pneumatic interrupter which in effect modulates the flow of electrical energy to the strip heaters located in the platen or mold surface. The electro-pneumatic interrupter serves to interrupt the flow of electrical energy by actuating a contactor which is in series with the electrical heating elements. In this particular scheme, it is quite important that control be applied to each platen as a safe-guard against failure of one of the heating elements in one of the platens.

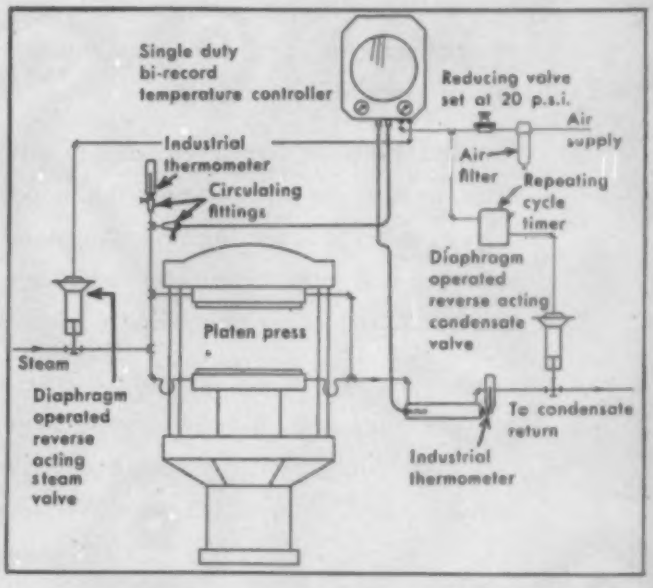
Inlet control with outlet record and condensate removal

The control system illustrated in Fig. 13 is one which is quite commonly used in the plastic and rubber industries on compression type presses. Here again, the recording temperature controller is used, but this time, it is of the single-duty bi-record form. The inlet steam temperature into each of the platens is controlled, but a record of the outlet condensate temperature is provided to indicate any plugging or stoppage in the steam passages of the platen. In addition to the recording temperature controller a repeating cycle timer is illustrated. The function of the timer is to periodically open and close a normally closed or reverse-acting type valve in the condensate line. The repeating cycle timer and normally closed or reverse-acting type condensate valve replace the conventional steam trap. This is to be recommended wherever the condensate control problem is difficult. It is recognized that this system is slightly wasteful of steam, but it does provide for an adequate purge of condensate from the steam-heated platen.

Other control elements

One of the elements that has not been previously mentioned is the addition of cooling water to the steam-heated platen for chilling the product so that it can easily be removed from the mold. This is not necessary in all types of plastic molding but is used in a great many. Where cooling is required, temperature control may or may not be applied—this being dependent upon the application requirements.

When heating and cooling are needed, it is important in



13—Wherever condensate control is a problem, this system guarantees an adequate purge of the steam-heated platens. The only disadvantage of this arrangement is that it has been found to be somewhat wasteful of steam

many cases to have the platen up to temperature for the following cycle. When this is the case, the time cycle controller must open the steam valve between cycles so as to bring the platens up to temperature. It is also quite important under these circumstances to have a signal light arrangement which will indicate when the platens are up to temperature. This provides a visual indication to the operator that the process cycle may be started.

On other types of critical plastic molding problems, it is necessary to provide an interlock circuit so that the operator cannot start the process cycle unless the platens are up to temperature. All of these features *(Please turn to page 218)*

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FABRICATION OF HIGH-PRESSURE LAMINATES

by RICHARD M. LANE

The purpose of this article and of Part II, which will appear in a subsequent issue of the magazine, is to make clear the logical relationship existing between the structure and certain properties of high-pressure laminates and the most efficient fabricating procedure determined by them. In this, Part I, we shall describe properties and show in a general way how singly or in combination they affect fabricating procedure. Then in Part II, the conclusion, we shall relate these properties specifically to groups of basically similar fabricating operations.

FAILURE to understand or make use of the relationship between the properties of a material and its method of fabrication is the usual cause of unnecessarily high fabricating costs. This holds true of any material, but is apt to be more common in the case of such high-pressure laminates as phenolics, ureas and melamines.

There are two reasons for this failure. First, the phenolic, urea and melamine laminates may be machined with fair economy on almost any type of machine and by any operator who has had some experience with metals. If no serious problems develop during the first experience with them in a shop, and if machining costs don't exceed those for similar operations on metals, these rather arbitrarily chosen methods and their results are accepted as standard. The other reason is directly connected with volume. Except in the shops of the largest users who have elected to do their own fabrication, the volume is seldom large enough to warrant a thorough investigation of the best machines and methods, or the installation of such machines and methods if an investigation were made.

The most obvious disadvantage of this state of affairs, of course, is that fabricating costs are higher than necessary on many of these materials now being fabricated. Another and more serious disadvantage is that designers who could utilize the unique combination of properties possessed by the high-pressure laminates are often discouraged by the differential in costs per pound between them and some other material. They become discouraged without knowing that in most cases this differential may be substantially reduced by efficient fabricating methods and that sometimes it may be wholly recovered or that savings may even be made.

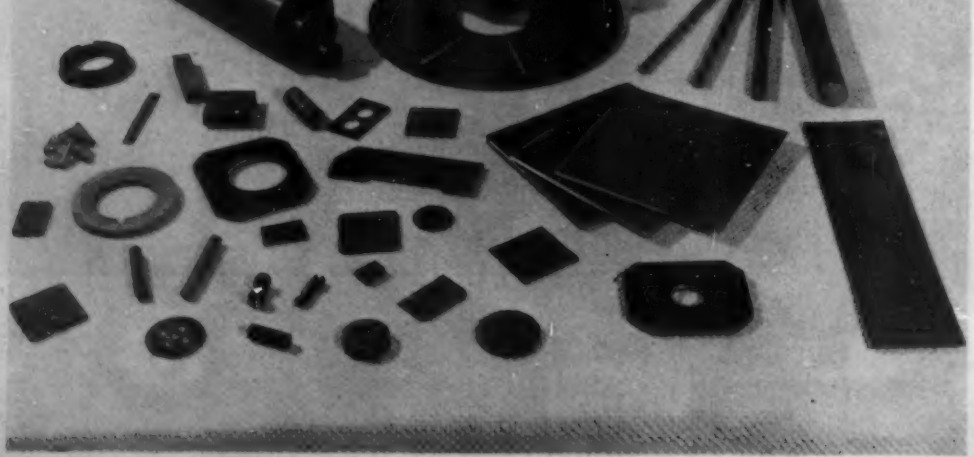
No attempt has been made in either this first article or in Part II, which will appear later on, to include detailed instructions on individual operations. Neither have any charts or formula been included relating to cutting speeds, feeds, tool design data, etc. We have omitted these because such information already exists in convenient form and may be procured from other articles which have appeared in this magazine and from the data books and other technical literature available from individual manufacturers.

This two-part article should give production engineers and other shop men sufficient information to decide if their fabricating methods for these materials should be investigated with a view toward greater economy. And, at the same time, it should give designers and draftsmen an over-all picture of the various standard and special methods for economically producing finished components from these materials. It should be emphasized that a simple comparison of price per pound with other materials is an insufficient basis for rejecting the high-pressure laminates for a proposed design or modification.

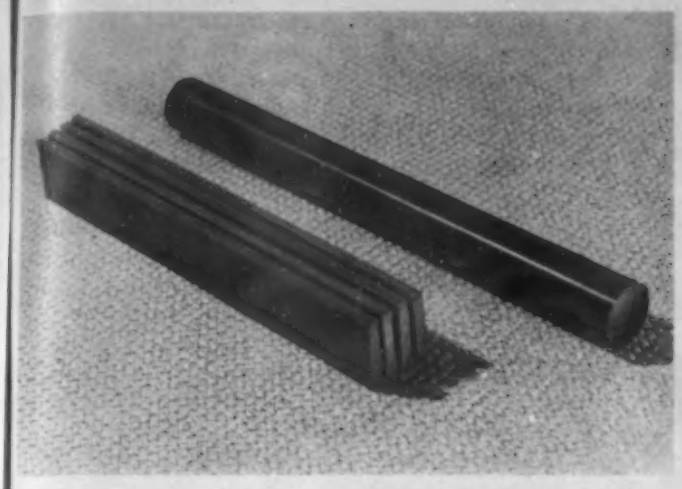
A comparison with metals

High-pressure laminated materials are approximately one half the weight of aluminum and have much lower shearing strength than most metals. In terms of fabrication this is

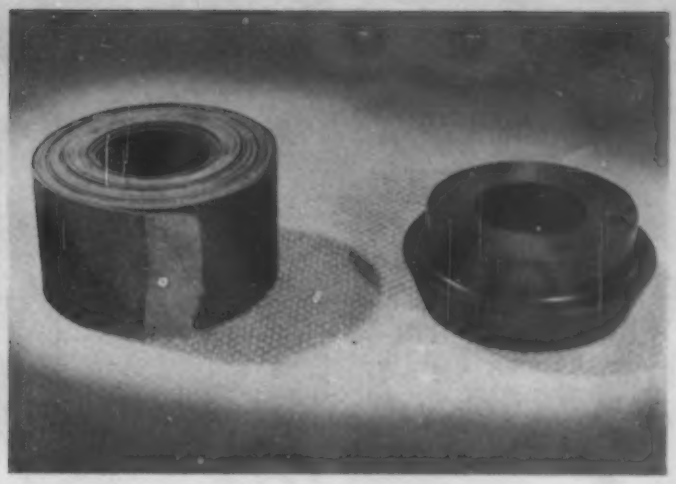
ALL PHOTOS, COURTESY FORMICA INSULATION CO.



1—Some of these specially shaped parts were molded; some were fabricated from sheets, rods and tubes



2—The semi-cured preform (left) from which the rod (right) was formed were loaded into the mold in such a way that pressure was applied parallel to the laminations



3—The antenna base at right was molded from a preform similar to the one at the left which is made up of semi-cured material inter-leaved with a sheet of uncured material

their chief advantage since it permits extremely high cutting speeds for most operations without serious problems arising from imbalance. Fabrication for many operations may be done on machines of light construction having a low first cost, low maintenance cost and lower power consumption. Because of this light weight, material handling from floor to floor and machine to machine is easier and less expensive.

Jigs, fixtures, tool holders and the tools themselves may be much lighter in construction than for similar operations in metals. On large production jobs this can be a very important cost item. For certain operations, the low shearing strength of the laminates permits the use of the high-speed machines of standard design used by the woodworking industry. This equipment covers circular saws, band saws and vertical spindle shapers. Exceptionally fine finishes and satisfactory tolerances may be achieved on some of these low cost machines when operated on a high production basis.

Resilience

Resilience may be defined as the property whereby materials return to the original position after being bent, compressed or stretched. From the standpoint of fabrication this property of high-pressure laminates can hardly be considered as an advantage, but it need not be a disadvantage if its effects are understood and provision made for them. A surprising amount of trouble can develop, if this property is ignored.

Among the common metals, brass is nearest to the high-pressure laminates with respect to resilience and behaves in exactly the same way under the action of cutting tools. Although to a slightly lesser degree, it will help us to understand the effect of resilience in relation to the sharpness of cutting tools if we consider what happens in the case of an extremely resilient material such as rubber. We may run a razor blade across a piece of gum rubber and slit it cleanly even with moderate pressure. With the same pressure on a dull knife, we merely indent the material. When the pressure is removed, the indented surface springs back to its original position. If we increase the pressure on the knife until the surface is fractured, we get a jagged tear instead of a clean slit as with a razor blade.

Something similar happens when we attempt to machine the high-pressure laminates with dull tools. It must be accepted as a basic rule that sensitivity to dull tools or to tools with insufficient clearance is very pronounced in these materials and that a bad appearance and errors in size are the inevitable results if this rule is violated.

Another rule, to which there are exceptions, is that positive top rake on cutting tools will result in poor finish and errors in size. The exceptions are high-speed circular sawing, certain milling operations and a few single point tool operations in lathes and automatic screw machines. For tapping, thread cutting on outside diameters, drilling, high-speed routing, form milling, form turning, cut-off operations and a number of other operations of a similar nature, it will be found that top rake will range from 0 to 10° *negative*.

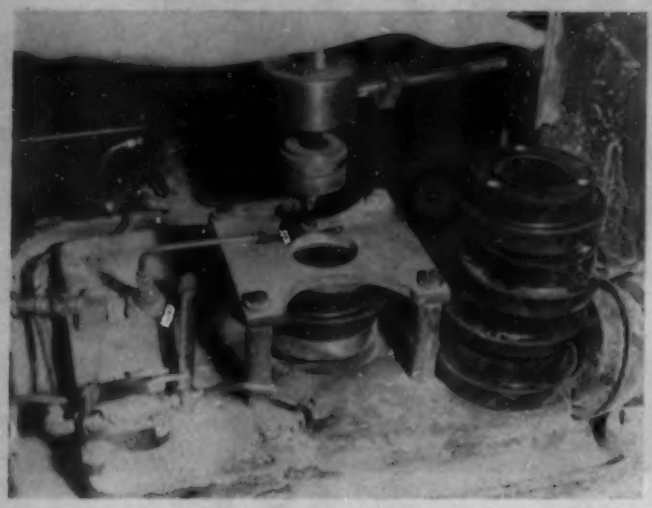
Due to resilience, these materials stretch or compress slightly under the action of all cutting tools even though the tools are kept sharp and have correct clearance. In broaching, punching, tapping, threading, drilling, hobbing, form milling, form cutting, etc., the hole or form produced on the work will be a close fit on, or will actually be smaller than, the tool used. As would be expected, the greatest variation occurs in punch press operations where the holes that are pierced will be several thousandths of an inch smaller than the punches, and the blanks several thousandths of an inch larger than the holes in the die—depending upon the thickness and grade of laminate.

In drilling, the hole produced by a properly sharpened drill will be 0.0005 to 0.002 in. smaller than the nominal diameter of the drill. Tapping will vary in about the same range as drilling. Broaching and hobbing will produce work a fraction of a thousandth smaller than the tools themselves. In relation to the finished part, it is common procedure to allow for this effect on punch press operations. Occasionally, when working to precision tolerances, this size difference will have to be allowed for in such operations as drilling, threading, tapping and broaching.

For most parts, however, this effect will be an advantage rather than otherwise. It must be remembered that this "hugging" of cutting tools and its effect will be more pronounced with dull tools or tools with insufficient clearance.

Low heat transmission

From the functional standpoint the excellent heat insulating property of these high pressure laminated materials is one of their main advantages. But from the standpoint of their fabrication, it is a distinct disadvantage and must be taken into account on all machining operations where the work or the tools rotate at high speed. In drilling, counterboring,



4—Jets of air remove dust and cool this tool as holes are threaded in these molded laminated antenna bases

5—As the inside diameter of a high-pressure laminated washer is turned, scraps are removed by a ventilator

6—This high-speed carborundum wheel, which is trimming the flash from the edges of this one-inch-thick glass fabric melamine laminate, is cooled with water

fly-cutting and other operations where the tool has little chance to cool during the actual cutting cycle, speeds have to be reduced from their practical maximum to avoid burning both work and tools. While lubricants are used on some operations, it is the common practice to machine these materials dry with adequate dust removal systems.

All cutting operations on these materials may be visualized as the rapid flow of an envelope of resilient, heat insulating material around the edge of a cutting tool. Because of the high coefficient of friction of these materials against metal when dry and the "hugging" effect due to resilience, heat is evolved very rapidly. Only a negligible amount of this heat can pass away from the point of cutting through the material. As a result, the very small cross section represented by the cutting edge of the tool is the path for a large amount of heat escaping through the body of the tool. High-speed steel tools will not retain the necessary keen edge for best appearance unless they are removed and ground quite often.

While it is not practical to employ carbide-tipped tools on all operations and for all types of tools, they should be used wherever possible, even for production of moderate volume. The ability of these tools to retain their keen edge under high temperatures gives them a pronounced economical advantage over other materials for cutting high-pressure laminates.

Another factor of fabrication determined by the heat insulating property is the speed on certain operations which will burn the material itself. It must be remembered that at temperatures above 350° F. the resinous bond of these materials may be damaged or destroyed and that such temperatures are easy to reach in localized areas.

Laminated structures

As their name implies, the materials under discussion are of laminated structure. They are built up by bonding individual plies of various base materials such as paper, cotton fabric, synthetic fabrics, etc., under heat and pressure. The strength of these materials is least in tension perpendicular to the laminations. In this connection, however, it must be understood that the bond is sufficiently strong with a high factor of safety for the many extremely severe mechanical functions these materials must perform. This fact is emphasized because the statement often is made that drilling and other operations parallel with the laminations must be performed with caution to prevent splitting of the stock. Without modification, such statements imply that these materials have low strength bonds which is not the case.

We may illustrate how the bond may be destroyed by describing a drilling operation parallel with the laminations. In most cases, holes drilled parallel with the laminations are two or more drill diameters deep. Because of the resilience of the materials and high coefficient of friction already described, heat, which is not transmitted away from an area immediately around the drill, is generated very rapidly. This heated section of stock expands, and the hole closes in around the drill generating more heat and causing greater expansion. The force built up perpendicular to the laminations due to this expansion against the drill and the extremely high heat involved will destroy the bond unless precautions are taken.

Actually, there is no more trouble drilling or machining parallel with the laminations than in any other direction if the heat factor is taken into account and sharp tools are used.

In this article we reviewed the effects of high-pressure laminate properties upon their fabrication. In Part II we will expand this information with a discussion of similar fabricating operations in relation to the properties of laminates.

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When ALL assembly costs are down in black and white... when TOTAL net assembly costs are figured... that's when SPEED NUTS really show results in the Cost Department.

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A letter describing your fastening problem will bring you full details on how SPEED NUTS will reduce YOUR total net assembly costs, too.

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Only SPEED NUTS provide a COMPENSATING thread lock and a SELF-ENERGIZING spring lock. As the screw is tightened the two arched prongs move inward to lock against the root of the screw thread. These free-acting prongs COMPENSATE for tolerance variations. Compression of the arch in prongs and base creates a SELF-ENERGIZING spring lock. These two forces combine to definitely prevent vibration loosening.

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*To Molders of Beetle**

The following are the facts concerning the

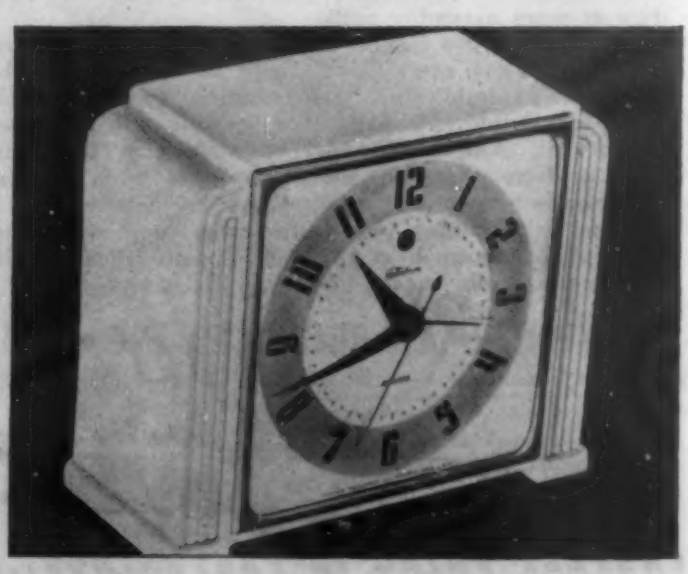
At the present time demand far outstrips available supply. In order to meet this critical situation, the American Cyanamid Company has under way a $2,000,000 expansion program of its plastics producing facilities. This will be completed as soon as materials and equipment are available. During 1946, we will increase our capacity to approximately 200% of our 1941 level.

DEMAND 1. There is a pent-up demand for consumer goods such as radios, clocks, electric razors and household appliances, items not produced during the war.

2. There is a wider acceptance of the excellent physical properties of BEETLE plastic—particularly its sales-stimulating colors.

3. During the war, there occurred a marked increase in the compression molding equipment. These new expanded facilities add to the call for BEETLE.

SUPPLY 1. During the war, it was not possible for raw material suppliers manufacturing plastics designed almost entirely for consumer goods to expand their facilities to meet anticipated demand.



The ivory BEETLE plastic case of this Telechron electric alarm clock, product of the Warren Telechron Company, has the charm of color, the pleasantness of texture, the lastingly beautiful finish to create and satisfy customers. Smart, quality appearance in BEETLE plastic housings can be achieved on a low cost, volume production basis.

Plastic and their Customers

availability of BEETLE molding compounds

2. At the termination of the war, labor shortages made it difficult to operate existing plants at capacity.

The Outlook for the Future

While it is still necessary for us to allocate material to our BEETLE customers, the situation is improving. No efforts are being spared to better the labor situation and plant expansion programs are moving rapidly.

During the year 1946, the situation will definitely be corrected and in the meantime we trust you will understand your molders' position as well as ours. We have the utmost confidence in the future and hope that you will continue to ask for BEETLE, *the plastic that's all color in all colors.*

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For distinctive, efficient product housings, such as this radio cabinet molded for the Emerson Radio and Phonograph Corporation, BEETLE plastic offers a combination of unmatched advantages. A broad range of colors can be utilized in design. BEETLE plastic is naturally insulating, dimensionally stable, can be quickly, accurately molded.

Distinctive containers and closures for Charles of the Ritz cake rouge, cream rouge, and eye shadow are molded of BEETLE plastic. Colorful BEETLE plastic is an ideal packaging material for cosmetics, beauty preparations, and other items that depend on eye appeal for initial as well as repeat sales. It is also chemically inert.

1—When light hits smooth polystyrene frames, it causes them to blend with almost any decor and highlights the photographs. Four frames and tabs are shown as they come from the mold (right). Separate parts and a complete frame appear in the foreground

Frames by the thousands

PRACTICALLY every G.I. and the gal-he-left-behind have had their picture taken during the war—and so have most of their relatives. Tech-Art Plastics Co., Inc., has approached this market with an economical injection molded transparent Styron frame (for 5- by 7- and 8- by 10-in. photographs) it produces at the rate of 10,000 per day. An efficient assembly line has been set up; and a unique device developed by the molder is employed to speed and improve production.

The frame is a one-piece clear plastic rectangle which has four molded bosses or lugs on the back. Tabs of the same material keep the photograph and backstand, attached to the frame by these lugs, in place. Four frames and twenty tabs (four for each frame plus four "extras") are injection molded in one die as can be seen from the sprue in Fig. 1. All flash is trimmed right at the press by four milling cutters. Practically no other finishing is necessary except that of separating the tabs and frames preparatory to assembly.

The frames are inspected and a sample photo inserted (Fig. 2). They are then sent down the line where the tabs, which have a small molded-in hole, are placed in position over the lugs by hand (Fig. 3). The frame is carried along by a moving belt to the third position in the assembly line. At this point, the operator places the frame in position in a jig set in an air-operated assembly device (Fig. 4). On the movable portion of this device are four peening fixtures, which are heated electrically. When a lever is thrown into operating position, the four heated peening fixtures contact the four bosses on the frame. The heat and pressure thus applied peens the ends of these bosses thereby making a permanent assembly of the tab and lug. This operation puts a head on each lug under which the tab can pivot in all directions. Pictures and backstands can be inserted and held securely in the frame without danger of the tabs dropping off.

Final operations, after frame is released from the jig, are the assembly of cardboard backstand, inspection and packing. The frame, named "Hi-lite," retails for less than one dollar.

2—The tab-fastening jigs, in the center section of this assembly line, help keep production up to 10,000 frames a day. 3—Prior to assembly, tabs are placed on molded lugs. 4—An electrically operated peening fixture puts a head on the molded lug which prevents tabs from dropping off but allows them to swivel

2

3

4

Tenite steering wheel molded by Shelter Mfg. Corp. for 1946 Packard

Foremost plastic of the automotive industry

Tenite has steered leading makes of American motor cars for ten years. During the war, it was a nautral choice for the steering wheels of landing craft, jeeps, and Army trucks, and control wheels for bombers. Now, Tenite is once again back in civilian life and will shortly make its appearance on the steering wheels of 1946 automobiles.

Motorists will also find Tenite used again for the control knobs, gear-shift levers, handles, and panels of their new cars. Colorful, shatterproof, pleasant to touch in any kind of weather, Tenite has proved ideal for interior appointments of motor cars in every price range.

Tenite is manufactured in a number of formulas which suit it to a wide variety of uses. It is available in unlimited colors — opaque, translucent, and transparent. For more information about Tenite, its properties and many uses, write TENNESSEE EASTMAN CORPORATION (Subsidiary of Eastman Kodak Company), KINGSPORT, TENNESSEE.

Tenite

an Eastman plastic

WHY TRANSFER MOLDING PRODUCES BETTER IRONS

Modern iron handle designs call for complex side cores and undercut sections and are therefore produced at minimum costs and with maximum production rates by Transfer molding.

Because the mold is closed when the already plastic compound enters, the fin is reduced to a minimum and the parting line becomes a line without dimension. In fact, alert designers peak the parting line, making a design feature of this molding effect and thus eliminating buffing and polishing.

Actually, several of the advantages of Transfer molding are called into play by production of iron handles: lower costs, faster and longer production runs, more beauty, easier complexity, uniform strength.

Your nearby licensed Transfer molder can help you take advantage of this process, or you can learn more by writing for the literature mentioned below.

SHAW

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LITERATURE IS AVAILABLE AS FOLLOWS:

A list of nearby licensees who can offer you the advantages of the patented Transfer molding process.

Two bulletins on "Why Transfer Molding is Economical". Bulletins on "Why Transfer Molding Gives Fine Inserts", "Why Transfer Molding Improves Appearance", "Why Transfer Molding Permits Better Holes", "Why Transfer Molding Permits Variable Walls", "Why Transfer Molding Gives Uniform Strength", and "Why Transfer Molding Gives Longer Runs".

Unbiased counsel in plastics applications is available from Shaw and Plax Corporation, Hartford 5, Conn. Between them, these companies use nearly all plastic processes. For names of nearby licensed Transfer molders and for literature listed above . . . write Shaw.

HOW TO POLISH PLAX POLYSTYRENE PRODUCTS

As indicated in the photograph, Plax polystyrene products may be polished to a high lustrous finish. Normal polishing is divided into "cutting down," which removes major surface defects, and "coloring," which produces the final luster.

Since the surface temperature of polystyrene should not be raised above 80°C (180°F), care should be taken to avoid polishing under too great a pressure, on too stiff a wheel, or with insufficient cooling. Such care will avoid "crazing" (surface cracking) and gumming.

Special, centrally air-cooled wheels will do the "cutting down" without excessive frictional heat. The "coloring" wheel should be soft, cotton buff—free of compound. 850 r.p.m. is a satisfactory speed for 14" wheels.

Cutting compounds, consisting of an abrasive held by a non-petroleum grease, are applied to the "cutting down" wheel. Line or chalk "coloring" compounds applied to the buffing wheel will remove the grease and bring out a lustrous surface.

If the polystyrene article has a poor surface, deep machining marks, or scratches, grinding is advisable before polishing. Wet-or-dry sand paper is used wet, grades 220 and 280 to cut a surface smooth and grades 400 and 600 to remove sanding scratches.

Polystyrene may be satisfactorily centerless ground by using a 46 grit Crystalon Norton wheel. A suitable coolant, such as Solvac 100M, should be used to prevent overheating. Neither kerosene nor oil should ever be used.

OTHER POLYSTYRENE DATA AVAILABLE

Bulletins on how to cement, how to machine, what to tell machinists, and how to use coolants—all on Plax polystyrene products—are available on request, along with information on standard and special forms of polystyrene offered by Plax.

Other literature is available on Plax Cellulose Acetate, Cellulose Acetate Butyrate, Methacrylate and other products—including one on plastic bottles. Engineering help covering nearly all plastics materials and methods is available from Plax and the Shaw Insulator Company, Irvington 11, N. J. For literature mentioned above . . . write Plax.

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TECHNICAL SECTION

DR. GORDON M. KLINE, Technical Editor

Plastics in Germany, 1939-1945, Part II*

by G. M. KLINE†

THIS report summarizes developments by I. G. Farbenindustrie A.-G. in adhesives, lacquer resins, solvents and plasticizers during the war. Production figures are given for these materials as well as for the various types of polymerization resins produced by I. G. Some of the information is taken from the minutes of the I. G. Organic Chemicals Conference held in Frankfurt on Sept. 22, 1943. The individuals who presented the various reports at that meeting are indicated in parentheses after each subject heading.

ADHESIVES

The Uerdingen plant was responsible for all quality control and development work on glues for I. G. They also produced pyroxylin glues (Cohesan) and polyvinyl ether glues (Cosal) for marketing at the rate of 140 and 17 tons/month, respectively. Urea-formaldehyde glues (Kaurit) were produced at Oppau to the extent of about 4000 tons/month. Polyurethane adhesives (Polystal) were produced at Leverkusen on a small scale for use in the aircraft field. They give a more elastic joint than the phenolic resins. The principal I. G. phenolic resin for gluing purposes was P 600 made at Troisdorf. Melamine resins for adhesives were made at Mainkur. Cosavult, an adhesive based on natural latex, was marketed by I. G. prior to the war. The principal producer of cellulose glues other than the pyroxylin type was Kalle and Co. at Wiesbaden, an I. G. subsidiary. They manufactured methyl cellulose adhesives (Glutolin and Glutofex) and one made of carboxymethyl cellulose (Cellaprit).

Polyurethane adhesives (Polystal)

These adhesives were made by the reaction of a polyisocyanate with a polyhydroxy compound. The following materials were employed for this purpose:

	Weight, percent
Polystal U I	
Desmophen 900 (made from 3 mols adipic acid and 4.2 mols trimethylolpropane)	70
Ethyl acetate (colored red with 0.017% Sudanrot BK 831307)	30
Polystal U II	
Desmodur TH (made from 3 mols tolylenediisocyanate and 1 mol hexanetriol)	75
Ethyl acetate	25

These are mixed in the proportion of 40 parts U I to 100 parts

1—American, British and Canadian investigators at Troisdorf. Front row (left to right): Kline, Crawford, Richardson, Goggin. Rear row (left to right) Gloor, Bond, Murdoch, Love, Rooney, DeBell

* Developments in the German plastics industry during the war have been thoroughly investigated by teams composed of technical representatives of the Ordnance Department, Quartermaster Corps, Chemical Warfare Service, Technical Intelligence Industrial Committee and other groups. The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it, but use of it by anyone must be and is at one's own risk insofar as the United States or foreign patent violations are concerned.

† Chief, Plastics Section, National Bureau of Standards. The assistance of Mrs. I. G. Caliomon, National Bureau of Standards, in translating the minutes of the I. G. conference is gratefully acknowledged.

U II immediately before applying; depending on the room temperature the mix has a pot life of 1 to 5 hours.

Urea mixed with 1 percent of Naphtolgrun B (a coloring material) was employed under the name "Polystal Beschleuniger Grun" as an accelerator. Without Polystal accelerator the cement requires 10 hr. to cure at room temperature; with it the cure is accomplished in 1 to 2 hours. The accelerator is spread on one side of the wood as a 20 percent solution in water and dried.

The thinner employed was composed of 98 percent water-free ethyl acetate and 2 percent butyl acetate; it was sold as "Polystal Verdunner N." The butyl acetate retards evaporation and prevents moisture condensation.

Polystal cement was used for waterproof gluing in aircraft construction. No moisture can be tolerated in the ethyl acetate or at the joint. It is dangerous to use a temperature higher than 60° C. in curing because of toxicity of the vapors; most curing is done at room temperature. Desmodur T (tolylenediisocyanate) was used with the Desmophen 900 prior to July 1944, but its use was discontinued at that time because of its toxicity.

Table I.—Compositions of I. G. Alkyd Resins

Resin designation	*Actual composition*
Drying Alkydals	
ST	28.2% phthalic acid 14.0% glycerol 57.8% ricinoleic acid
STO	Contains 2% more oil than ST
STK	32.0% phthalic acid 23.2% trimethylolpropane 39.8% ricinoleic acid 5.0% fore-run fatty acid from Fischer-Tropsch oxidation of paraffin
TT Special	39 parts phthalic acid 20 parts glycerol 50 parts castor oil
L	27.7 parts phthalic acid 13.4 parts glycerol 64.7 parts linseed oil
L Extra	41% glyceryl phthalate 59% linseed oil fatty acid
T	35.3% phthalic acid 15.3% glycerol 49.4% linseed oil fatty acid
TO	Contains 2% more oil than T
T Extra	32 parts phthalic acid 19 parts glycerol 42 parts linseed oil 14 parts chinawood oil
TK	58% glyceryl phthalate 42% linseed oil fatty acid
U 50S	51% phthalate ester of pentaerythritol and hexanetriol 49% linseed oil fatty acid
UTO	53% phthalate ester of hexanetriol 47% linseed oil fatty acid
L45	57% phthalate resin 43% fatty acids from linseed oil and fore-run fatty acid
TT	47 parts phthalic acid 25 parts glycerol 37 parts linseed oil
Non-Drying Alkydals	
NT	43 parts phthalic acid 22 parts glycerol 43 parts peanut oil
RD 10	50.9% phthalic acid 1.0% maleic acid 39.7% hexanetriol 8.4% fore-run fatty acid
RD 18	31.7% phthalic acid 10.5% adipic acid 1.0% maleic acid 36.4% trimethylolpropane 20.4% fore-run fatty acid
RE 25 (alcohol-soluble)	35.9% phthalic acid 1.0% maleic acid 39.6% hexanetriol 23.5% fore-run fatty acid
W	42 parts phthalic acid 26 parts glycerol 44 parts castor oil

Polyvinyl ether adhesives (Cosals)

Cosal adhesives were based on polyvinyl ethers, chiefly polyvinyl isobutyl ether. They were generally supplied as solutions in benzine, acetone or esters. Their principal use was in installing upholstery in motor cars, sealing cellophane and other foils, and in cementing materials to glass and metal. Approximately 200 tons were made in 1943.

Cosal D 12 was the most important in peacetime. It is used for cementing car upholstery; 700 kg. were made during the 4th quarter of 1944. Its composition is as follows:

Igevin I 60 (polyvinyl isobutyl ether made at Ludwigshafen)	36.0 parts
Casein	6.0
I. G. Wachs S II	2.0
Boric acid	0.6
Salicylic acid	0.6
Ammonia (25 percent tech.)	2.3
Water	43.5
Benzine	9.0

A solution of casein 6, water 16 and ammonia 0.6 parts are mixed hot with a solution of I. G. Wachs S II 2, water 5 and ammonia 1. Then 45 parts of an 80 percent solution of Igevin I 60 is warmed to 50° C. and added to the above mixture. Then a solution of boric acid 0.6, salicylic acid 0.6, water 6.0

Table II.—Composition of KM Resins Made by I. G. at Ludwigshafen

Resin designation	*Components to make 100 parts resin*	
	Parts	*Material*
KM resin extra hard	90	Rosin[a]
	7.5	Maleic anhydride
	13.5	Glycerol
KM resin pale	93	Rosin
	9.3	Maleic anhydride
	13.5	Glycerol
KM resin special	90	Rosin
	5	Maleic anhydride
	13.5	Glycerol
KM resin alcohol-soluble	90	Rosin
	7.6	Maleic anhydride
	14.6	Glycerol
KPM resin	102	Rosin
	2.2	Maleic anhydride
	10.0	Pentaerythritol LG

[a] Before the war, American Newport Resin WW was used; during the war, French Balsam Oil. The proportions used remained the same, but the resins made with the French rosin are somewhat darker.

2

3

2—The ruins of the laboratory at the I. G. Ludwigshafen plant in which Baeyer first synthesized indigo. 3—The Rohm and Haas plant at Darmstadt. One raid in Sept. 1944, lasting only a few minutes, entirely halted production here

and ammonia 0.7 is added to the mix at room temperature, followed by 16.5 parts of water.

Cosal U 990 is used to stick Vinidur (unplasticized polyvinyl chloride), paper, etc., together or to glass and metals. During the 4th quarter of 1944, 5200 kg. were produced. Its composition is as follows:

Oppanol C (polyvinyl isobutyl ether made at Oppau)	11.0 parts
Igevin I 60	18.4
Harz He 44	7.2
Methyl acetate	19.8
Ethyl acetate	29.8
Methanol	5.8
Acetone	3.4
Benzine 65/95	4.6

The Oppanol C is dissolved in ethyl acetate and the Igevin and Harz He 44 are added, followed by the solvents. Harz He 44 is a resin made from solvent naphtha.

Cosal U 989 was sold in tubes for use in cementing foils and car upholstery; 20,200 kg. were produced in the 4th quarter of 1944. Its composition is as follows:

Oppanol C	13.5 parts
Igevin I 60	32.4
Benzine 65/95	54.1

Cosal U 211 was used for cementing rubber to wood, glass and metal; 9600 kg. were produced in the 4th quarter of 1944. Its composition is as follows:

Igevin I 60	43.3 parts
Carbon black (Russ Sorte P1101)	17.25
Ethyl acetate	35.55
Kristallol 30 (white spirits)	3.9

Cosal U 364 was used in place of U 211 when a gray finish

TABLE III.—LUPHEN RESINS USED IN PROTECTIVE COATINGS

Resin designation	*Phenol resin components*[a]			*Soft resin components*		*Ethyl cellulose solution*[f]	*Final composition*		*Ratio, phenol resin: soft resin*
	Phenol resin	*Ethyl alcohol*[b]	*Ethylene glycol monoethyl ether*[b]	*Soft resin*[c]	*Ethylene glycol monoethyl ether*[d]		*Solids*	*Liquids*	
AW (60%)	24	20	10	36	9	1	60	40	2:3
AT (60%)	30	24	10	30	5	1	60	40	1:1
AM (60%)	42	29	7	18	3	1	60	40	7:3
H (50%)	44.95	25	25	4.95 Product 1603[e]	...	0.1	...	...	...
	p-tert-Butyl phenol resin	*Ethylene glycol monomethyl ether acetate*	*Butyl alcohol*						
BT (80%)	40	3	3	40	13	1	80	20	1:1
B (80%)	56	5	5	24	8	2	80	20	7:3

[a] Luphenhärter 10, which is benzotrichloride (*a*-trichlorotoluene), was used as a hardening agent for Luphen resins.
[b] Instead of the mixture of ethyl alcohol and ethylene glycol monoethyl ether, the same amounts (i.e., 30, 34 and 36%) of butyl alcohol, propyl alcohol or ethylene glycol monoethyl ether alone can be used.
[c] The soft resin (Weichharz AT) is made by reacting 100 parts of adipic acid with 112 parts of trimethylolpropane.
[d] Butyl alcohol can be used in place of ethylene glycol monoethyl ether.
[e] Product of reaction of acetylene and dimethylolurea made up to 30% solution in ethylene glycol monoethyl ether. Percentage in table is for amount of solid resin.
[f] A 10% solution of medium-viscosity ethyl cellulose B 500 in a mixture of xylene and ethyl alcohol.

TABLE IV.—I. G. SHELLAC-TYPE SYNTHETIC RESINS

Resin designation	*Source of resin*	*Composition*
Kunstharz FX	Op	Acetaldehyde condensed with diethylamine as catalyst
Phtalopal PP	Lu	Pentaerythritol phthalate
Phtalopal 1156	Lu	Trimethylolpropane phthalate
Phtalopal SEB	Lu	Hexanetriol phthalate (50/50)
Kunstharz 26M	Lu	Condensation product of phenol, cyclohexanol and formaldehyde (without condensing agent)
Alkydal Pg (Kunstharz Gl)	Lu	Glycerol phthalate made with 78 parts phthalic acid and 32 parts glycerol

TABLE V.—I. G. NITROGEN-CONTAINING RESINS USED IN PROTECTIVE COATINGS

Resin designation	*Source of resin*	*Composition*
Plastopal W	Op	Solid alcohol-soluble urea-formaldehyde condensation product condensed in butyl or isobutyl alcohol
Plastopal H	Op	Hard form corresponding to above
Plastopal CB	Op	50% solids 89% urea-formaldehyde resin 11% alkydal resin made from phthalic and maleic anhydride and 1.3-butylene glycol 50% liquids 88 to 89% butyl alcohol 10 to 11% toluene 1 to 2% water
Plastopal AT	Lu	25% urea-formaldehyde condensation product 25% soft resin AT 50% butyl alcohol
Plastopal AW	Lu	10% urea-formaldehyde condensation product 40% soft resin AT 50% butyl alcohol
Plastopal ATX	Op	54.2 kg. formaldehyde (30%) 14.1 kg. urea (technical) 22.5 kg. butyl alcohol 0.7 kg. toluene 26.6 kg. hexanetriol 23.3 kg. adipic acid 21.1 kg. propyl alcohol
Maprenal MIB	Ma	Condensation product of: 3200 parts melamine 805 parts formaldehyde (37%) 2560 parts isobutyl alcohol
Maprenal BG	Ma	Condensation product of: 1440 parts benzoguanamine (2-phenyl-4,6-diamino-1,3,5-triazine) 3420 parts formaldehyde (37%) 2100 parts isobutyl alcohol
Igamid 40 B	Lu	36.22 parts hexamethylenediamine adipate 38.00 parts ω-aminocaprolactam 24.09 parts hexamethylenediamine ketopimelate 1.90 parts hexamethylenediamine succinate

was required. It was not as satisfactory in adhesion as the latter; 3200 kg. were produced in the 4th quarter of 1944. Its composition is as follows:

Igevin I 60	21.4 parts
Carbon black	11.0
Chalk	48.5
Tricresyl phosphate	5.0
Dibutyl phthalate	5.0
Ethyl acetate	9.1

Cosal UL was used in place of rubber latex during the war for shoe manufacture. It is not as satisfactory as latex; 11,900 kg. were produced during the 4th quarter of 1944. Its composition is as follows:

Oppanol C	11.5 parts
Igevin I 60	11.0
Harz He 44	5.5
Methyl acetate	23.5
Ethyl acetate	34.75
Methanol	6.9
Acetone	4.1
Benzine 65/95	2.75

Cosal 900 was used for gluing rubber parts. Its composition is as follows:

Oppanol C	25 parts
Benzine 65/95	75

Cosal Verdunner 420 is composed of 50 parts methylene chloride and 50 parts carbon tetrachloride. It was used as a thinner for the Cosals.

Cellulose nitrate adhesives (Cohesans)

The Cohesans are based on nitrocellulose. They were used for household and general purpose gluing. There are many formulas differing in solvent and plasticizer composition. The following formula for Cohesan WP is a typical one:

Nitrocellulose K-Wolle B (dry)	16.57 parts
Dibutyl phthalate	0.50
Methyl acetate	18.36
Ethyl acetate	45.20
Methanol	9.00
Isopropyl alcohol	1.44
Sprit (ethyl alcohol)	8.93

Urea-formaldehyde adhesives (Kaurits)

Kaurit W, the urea-formaldehyde resinous base of the Kaurit glues, was made at Oppau. One mol of urea (technical) and 2 mols of formaldehyde (30 percent solution) were reacted together to form a 36 percent resin solution. This was concentrated by heating at 65° C. in vacuo. Then 8 to 10 percent of wood, rye or potato flour was added to yield a mixture composed of 55 percent resin, 10 percent flour and 35 percent water. This was neutralized to pH 7.0 with sodium hydroxide and was designated Kaurit W-Liquid. To make Kaurit W-Pulver (powder) it was spray dried to 2 to 3.5 percent moisture content. In 1937 a Kauritfilm W was made but proved to be too unstable for commercial use.

Kaurit MS-Pulver was used during the war to extend the available supply of Kaurit W for the manufacture of plywood by hot pressing. Its composition was as follows:

Kaurit W-Pulver	66 parts
Quellit T95 (potato meal)	26
Woodflour	5
Holzather (methyl cellulose)	3

TABLE VI.—I. G. CHLORINE-FREE POLYMERS USED IN LACQUERS

Resin designation	*Forms available*	*Composition*
Mowilith 70	Solid and 25% solution	Polyvinyl acetates with various K-values[a]
Mowilith 50	Solid	
Mowilith 30	Solid and 60% solution	
Mowilith 20	Solid and 50% solution	
Mowilith 15	60% solution	
Acronal II (high viscosity)	Solid and 27% solution	Polyethyl acrylate
Acronal II (high viscosity)	Solid and 30% solution	Polyethyl acrylate
Acronal II (low viscosity)	50% and 60% solution	Polyethyl acrylate
Acronal IV (low viscosity)	50% and 60% solution	Polybutyl acrylate
Acronal 700 (low viscosity)	50% solution	Mixed polymer 75% butyl acrylate 25% vinyl isobutyl ether
Acronal IT	Solid	Mixed polymer 60% methyl acrylate 40% acrylonitrile
Polystyrene L	Solid	Polystyrene
Polystyrene B	Solid	Mixed polymer 70% styrene 30% butyl acrylate
Oppanol B 50	Solvent-free	Polyisobutylene
Oppanol B 100	Solvent-free	Polyisobutylene
Oppanol B 200	Solvent-free	Polyisobutylene
Oppanol C	Solvent-free	Polyvinyl isobutyl ether
Igevin A 50	Solvent-free and 50 and 70% solutions	Polyvinyl ethyl ether; K-value 50
Igevin A 25	Solvent-free	Polyvinyl ethyl ether; K-value 25
Igevin J 60	Solvent-free and 70 and 80% solutions	Polyvinyl isobutyl ether; K-value 60
Igevin M 40	Solvent-free and 50 and 70% solutions	Polyvinyl methyl ether; K-value 40

[a] Translators' Note: Fikentscher's viscosity coefficient, k, is calculated as follows:

$$\frac{\log \eta_{rel}}{c} = \frac{75k^2}{1 + 1.5\,k.c} + k$$

where c is the concentration in g./100 cm.^{3} of solution and η_{rel} is the ratio of the viscosity of the solution to that of the pure solvent. The K-values are reported as 1000 times the calculated viscosity coefficient in order to avoid the use of decimals.

These ingredients are mixed in a rotating drum. The potato meal is made by grinding on hot rolls (above 100° C.). This glue is not water-resistant.

Kaurit WHK-Pulver is a cold assembly glue. Its composition is as follows:

Kaurit W-Pulver	75.7 parts
Trolitan-Pressabfalle	21.65
Paraformaldehyde	2.65

The bulk density of this powder is about 65 g./100 cc. The Trolitan-Pressabfalle is a phenolic powder prepared from rejected moldings or flash at Troisdorf which is ground and passed through a 0.3-mm. sieve.

Hardeners for Kaurit—The hardener generally used for hot-press work is the *heat hardener liquid* which has the following composition:

Tombalin paste (5 percent)	0.3 parts
Water	19.6
Ammonia (25 percent)	27.0
Ammonium chloride	8.0
Urea (technical)	45.0
Rhodamin—B extra (red) 1:1000 in water	0.1

Tombalin paste is a 5 percent solution of methyl cellulose in water, added to raise the viscosity. Previously 1 part of Glutolin SL 400 (Kalle) was used and is preferred. The Tombalin is mixed with an equal amount of hot water and allowed to stand overnight. It is then mixed with the other components at 35° C. and filtered through a hair sieve. Ten parts of this hardener were used with 100 parts Kaurit W-Liquid; the pot life was about 24 hours.

Heat hardener Braun Neu was employed when more rapid hardening was desired. Its composition is as follows:

Tombalin paste (5 percent)	0.3 parts
Ammonium chloride	15.0
Urea	30.0
Water	33.2
Ammonia (25 percent)	20.0
Directschwarz E extra 1:1000 in water	0.5
Renolbraun MB extra 1:1000 in water	0.5
Congolbraun G. knoz. 1:1000 in water	0.5

(Please turn to next page)

TABLE VII.—I. G. NONSAPONIFIABLE RESINS USED IN PROTECTIVE COATINGS

Resin designation	*Source of resin*	*Composition*
Alkyphen resin AP 4	Lu	Condensation product of *p-tert*-butylphenol and formaldehyde
Styresin H	Le	Styrene-phenol resin containing about 90% polymerized styrene, remainder condensed with phenol or phenol esters
TC-Harz	Elb	Cumarone polymerization product (special process)
Kunstharz AW2	Lu	Condensation product of 2 parts methyl cyclohexanol, 1 part cyclohexanol with methyl alcoholic potash under mild conditions
Kunstharz AP	Hu	Polyvinylphenylketone
Clophen Harz W	Le	Chlorinated diphenylbenzene (terphenyl[a]) with 59% chlorine
Clophen Harz C	Le	Chlorinated phenyl-diphenyl-sulfone

[a] The terphenyl is obtained as a by-product in the preparation of diphenyl. The crude terphenyl is purified by distillation and washing with alcohol to the desired melting point and is then chlorinated, treated with sodium hydroxide and distilled in vacuum.

Typical formulas for use of the heat hardener are as follows:

	Formula 1	*Formula 2*
Hardener Braun Neu	20 parts	20 parts
Kaurit W-Liquid	100	100
Potato flour	20	30
Woodflour	8	10
Water	135	200

Heat hardener K-Pulver was used when maximum water resistance was required. Its composition is as follows:

Resorcinol (tech., 2 RM./kg.)	90 parts
Ammonium chloride (tech.)	10

The finely ground constituents are mixed dry and stored in airtight containers. Depending on the water resistance required, 10 to 25 parts of K-Pulver are mixed with 100 parts Kaurit W-Liquid.

For cold gluing work *Kaltharter Gelb Pulver* and *Rot Pulver* were most generally used. The red glue can be easily seen on wood to check on uniform coverage. The yellow glue is used for furniture, etc., where the red color is objectionable. The compositions of these hardeners are as follows:

	Yellow	*Red*
Ammonium chloride (tech.)	99.98 parts	99.9 parts
Naphtolgelb SXX	0.02	...
Rhodamin B extra	...	0.1

The dye is mixed with a small amount of ammonium chloride in a ball mill and then with the balance of the ammonium chloride. One side of the veneers to be bonded is coated with a solution consisting of:

Kaltharter Gelb or Rot	15 parts
Water	78
Sprit (ethyl alcohol)	6

The coated veneers are dried at room temperature. The other side of the veneers is coated with Kaurit W and they are then pressed together immediately. The hardening time is 3 hr. at 20° C., 10 hr. at 15° C. or 24 hr. at 10° C. No hardening occurs below 6° C.

Kaltharter Blau Pulver or *Weiss Pulver* was used for large surfaces which required glue having a longer curing time. The compositions of these hardeners are as follows:

	Blue	*White*
Ammonium chloride (tech.)	17.00	17
Urea	82.94	83
Methyleneblau B extra	0.06	..

The method of mixing is the same as for the yellow and red hardeners. They must also be kept dry and stored in airtight containers. They are mixed with water and ethyl alcohol to prepare a solution of the following composition for application to veneers:

Ammonium chloride	8 parts
Urea	40
Water	45.5
Sprit (ethyl alcohol)	5.0

Foam Hardener *Bu-Pulver* (*HK 986*) was employed for curing Kaurit W which was made up into a foam for application to veneers in the manufacture of plywood. This hardener had the following composition:

Ammonium bicarbonate	60.0 parts
Ammonium chloride (tech.)	22.5
Holzmehl W14 (woodflour)	17.3
Eisenoxygelb 420 (coloring)	0.2

The ingredients are mixed together as fine powders. The foamed Kaurit glue had the following composition:

Casein	9 parts
Bu Pulver	120
Kaurit W-Liquid	1000
Woodflour	15
Potato starch	60
Water	600

The casein, 60 parts Bu Pulver and 400 parts boiling water are mixed together in the foam-producing machine. Then the other components are added as follows: Kaurit W-Liquid, woodflour, 60 parts Bu Pulver, potato starch, 200 parts cold water. The foam has 2.5 to 3 times the volume of

4—An ancient castle looks down upon the town of Heidelberg and the wreckage of bridges in the Neckar river

TABLE VIII.—MISC. COMPOUNDS USED IN THE EMULSION FIELD

Trade name	*Forms available*	*Composition*
Collacral N (Appretan C)	16% aqueous solution	Mixed polymer 75% acrylonitrile 25% methyl acrylate partially saponified with ammonia
Latekoll A	10% aqueous solution	Ammonium polyacrylate
Latekoll N	25% aqueous solution	Sodium polyacrylate
Vultamol (Neutralsalz II; Tamol NNO)	Solid	Sodium salt of the condensation product of β-naphthalene sulfonic acid and formaldehyde
Mersolate	...	Sodium salt of C_{13}–C_{18} Fischer-Tropsc hydrocarbon sulfonates
Rohagit S	...	Mixed polymer, alkali-soluble 65% methacrylic acid 35% methyl methacrylate
Amphoseife 18	...	Sodium salt of oxyoctadecane sulfonic acid
Emulphor O	...	Product of reaction of octadecyl alcohol and ethylene oxide

the liquid. It is spread directly on the faces of the veneers. Although casein was very scarce in Germany during the war, it was allocated for this application.

Cold-setting phenolic adhesive (P 600)

A phenolic resin adhesive was desired for cold assembly work in aircraft construction. It was found that P 600 resin, made with 100 parts phenol and 180 parts formaldehyde, catalyzed with 3 parts sodium hydroxide, could be cured at room temperature with *p*-toluenesulfonic acid (TW-Harter). The TW hardener is used in the proportions of 1 part to 5 parts P 600. It has a specific gravity of 1.145; 100 gm. is equivalent to 87.5 cc.

The optimum gluing temperature is 20° C., at which the pot life is approximately 6 hours. The curing time is approximately 12 to 15 hr. to the maximum strength[1] (100–130 kg./cm.²); after 3 to 5 hr. the strength is 40–50 kg./cm.²

The adhesive is not dependent on thin glue lines for strength. Specimens with gaps of 5 to 6 mm. give normal tensile-shear strength.

The strength of pine specimens bonded with P 600 is reduced from 90 to 60 kg./cm.² by immersion in water for 100 hr. at 20° C.; that of resin-bonded beech from 120 to 80 kg./cm.² After air drying for 48 hr., the strength is restored to 90 percent of the original value. Boiling in water for 8 hr. reduces the strength of the pine specimen to 48 kg./cm.²; that of beech specimen to 65 kg./cm². After 48 hr. at room temperature strength values are 59 and 83, respectively.

A decrease in strength of approximately 20 percent occurs when the pine specimens are heated at 100° C. for 100 hr.; the beech specimens show a decrease in strength from 120 to 104 kg./cm². Similarly, 100 hr. at 80° C. and 100 percent relative humidity causes a decrease in strength of 30 percent for the pine and 17 percent for the beech.

Production progress (from a report by Schnell)

The average monthly production of each material manufactured during 1942 and the first half of 1943 is compared

[1] To convert from kg./cm.² to lb./in.², multiply by 14.2.

TABLE IX.—I. G. CHLORINE-CONTAINING POLYMERS USED IN LACQUERS

Resin designation	*Forms available*	*Composition*
Pergut 3N Pergut N Pergut H Pergut HH	Solvent-free	Chlorinated rubber
Vinoflex PC, Type N Vinoflex PC, Type H	Solvent-free	Chlorinated polyvinyl chloride
Vinoflex PCU 3	Solvent-free; 28% in mixed solvents	Polyvinyl chloride M number[a] 3
Vinoflex PCU 8	Solvent-free; 15% in mixed solvents	Polyvinyl chloride M number 8
Vinoflex PCU 20	Solvent-free; 5% and 20% in mixed solvents	Polyvinyl chloride M number 20
Vinoflex MP 400	Solvent-free	Mixed polymer 75% vinyl chloride 25% vinyl isobutyl ether

[a] The M number is determined by dissolving 1 g. of polymer in a solvent consisting of 1 part of epichlorohydrin to 3 parts chlorobenzene, heating to dissolve, and cooling to gelling temperature. The cc.'s of solvent required to give a gelling temperature of 20° C. is the M number.

TABLE X.—I. G. EMULSION POLYMERS USED FOR PROTECTIVE COATINGS

Resin designation	*Forms available*	*Composition*
Mowilith D	50% and 60% in emulsion; powder (FD)	Polyvinyl acetate made with 5% polyvinyl alcohol as emulsifying agent
Mowilith D 32	58% and 66% in emulsion	Polyvinyl acetate with 50% plasticizer: 3 parts tricresyl phosphate 2 parts dibutyl phthalate
Mowilith D 300	48% in emulsion	Mixed polymer 70% vinyl acetate 30% vinyl chloride with 30% plasticizer (mixture of Palatinols V and C)
Acronal I D	25% and 40% in emulsion	Polymethyl acrylate
Acronal II D	25% and 40% in emulsion	Polyethyl acrylate
Acronal 300 D	50% in emulsion	Mixed polymer 32.4% butyl acrylate 32.4% vinyl acetate 32.4% vinyl chloride 2.8% Amphoseife
Acronal 430 D	50% in emulsion; 30% thickened emulsion	Mixed polymer 50% vinyl isobutyl ether 30% methyl acrylate 20% acrylonitrile (thickening agent: 10% Collacral N [Table VIII])
Acronal 450 D	40% in emulsion	Mixed polymer 66% ethyl acrylate 20% vinyl isobutyl ether 12% styrene 2% acrylic acid
Acronal 500 D	50% in emulsion	Mixed polymer 48% butyl acrylate 48% vinyl acetate 2% acrylic acid 1% Amphoseife 18 1% Emulphor O

TABLE XI.—PRODUCTION OF LACQUER RESINS BY I. G.

Resin	*Planned production*	*1942 production*	*1st half 1943 production*	*Fulfillment of plan in 1943*
	t./mo.	*t./mo.*	*t./mo.*	*percent*
CONDENSATION TYPES				
Alkydals (alkyds)	1000	883	1000	100
Plastopals (ureas)	416	236	295	70.8
Luphens (phenolics)	267	102	100	37.5
Uresin B (butylurethan-formaldehyde)	167	37	76	45.5
Phtalopals (phthalates)	117	104	96	82
Kunstharz AP (vinyl-phenylketone)	117	72	85	72.5
KM Resins (rosin-glycerol-maleic)	100	70	84	84
Maprenal (melamine)	84	31	59	70.2
Kunstharz AW_2 (cyclohexanone and methylcyclohexanone)	75	84	95	126.5
Clophenharz W (chlorinated diphenylbenzene)	70	10	9	14.3
Styresin H (styrene-phenol)	25	...	...	...
Total	2438	1629	1899	82
POLYMERIZATION TYPES				
Vinoflex (polyvinyl chloride)	333	117	168	50.4
Acronal (polyacrylates)	250	50	27	10.8
Igevin (polyvinyl ethers)	188	72	63	33.5
Mowilith (polyvinyl acetates)	183	82	90	49.2
Miscellaneous resins	...	31	36	..
Total	954	352	384	40.2
Total for all resins	3392	1981	2283	67.3

with the demands of Jordan's lacquer plan in Table XI.

Table XII shows the share of the most important producers, including I. G., in the lacquer raw material production plan. They met approximately 62 percent of their scheduled production which is somewhat lower than that reached by I. G. alone (67.3 percent).

Table XIII summarizes the situation for the whole field of lacquer raw materials in Germany.

Application development (from a report by Jordan)

In order to show the synthetic lacquer resins in their reciprocal relationships, the speaker chose a new form of graph: the synthetic lacquer resin circle. Concentric circles of equivalent value represent the lacquer raw materials according to the mechanical properties of their films with respect to hardness and toughness (film strength). As the four points of the axes were chosen the properties: *hard-brittle* (natural resins), *hard-tough* (cellulose esters), *soft-tough* (rubber) and *soft-plastic* (balsams-balata). This system includes all degrees of toughness and hardness and permits fixing in broad outline the position of each lacquer raw material from the viewpoint of its film properties.

The synthetic resin circle shows that we can produce products with almost all mechanical properties. On the other hand, certain chemical groups such as polyvinyl ether and polyvinyl acetate are able to meet a very great range of film properties and degrees of solubility. Accordingly, for each

TABLE XII.—PRINCIPAL GROUPS IN THE GERMAN LACQUER PLAN

	Capacity		*Sales*		
	Plan	*Present*	*Amount*	*Percentage of capacity*	*Percentage of plan*
	t./yr.	*t./yr.*	*t./yr.*		
Nitrocellulose	10,000	10,000	9,000	90	90
Rosin derivatives	8,400	8,400	8,000	95	95
Alkyds (oil-type)	25,300	25,300	16,000	67	67
Alkyds (oil-free)	2,000	2,000	1,500	75	75
Phenolic resins*	19,000	12,000	5,000	40	26
Urea resins	6,920	6,400	3,900	61	56
Ketone resins, etc.	2,400	2,400	2,100	86	86
Total	74,020	66,500	45,500	69	62

* Without Raschig G.m.b.H.

principal application field it will be necessary to select a limited number of types which can be used for many purposes. During the war, these types may well differ from those used after the war. Since they can often be produced with the same equipment, these products are very adaptable to changing demands.

It is of interest to consider in which sectors of the synthetic lacquer resin circle are the centers of interest. The *hard-tough* products, as good film producers, surpass by far all others, especially if one includes the oil-containing alkyds whose dried film belongs here. High film strength and resistance to abrasion are among the most important properties of a lacquer film-forming material.

Another focal point is in the sector of the *hard-brittle* products. They serve as low viscosity, soluble, bodying, compounding materials for the good film-formers, especially the hard-tough group, to alter the mechanical and chemical properties.

During the last few years the *soft-plastic* products have been gaining rapidly in importance, especially Uresin (butylurethan-formaldehyde), Igevins (polyvinyl ethers), Phtalopals (phthalates), RD-Alkydals (alkyds), Carbo resins (the latter among other reasons because they save solvents) and oxide pitch O which can be used for many purposes. In round numbers the quantitative relationship between the three groups is 38,000:16,000:6,000 tons.

The *soft-tough* products are for the present of little importance in the lacquer field. This is partly because some fields of textile surface treatments, for instance, the coating materials, are counted as plastics. Many possible applications of lacquered papers and textiles cannot be developed at this time. Furthermore, the Oppanols (polyisobutylenes) are not being allocated now for many purposes.

The most important developments in the various product groups are summarized in the following paragraphs.

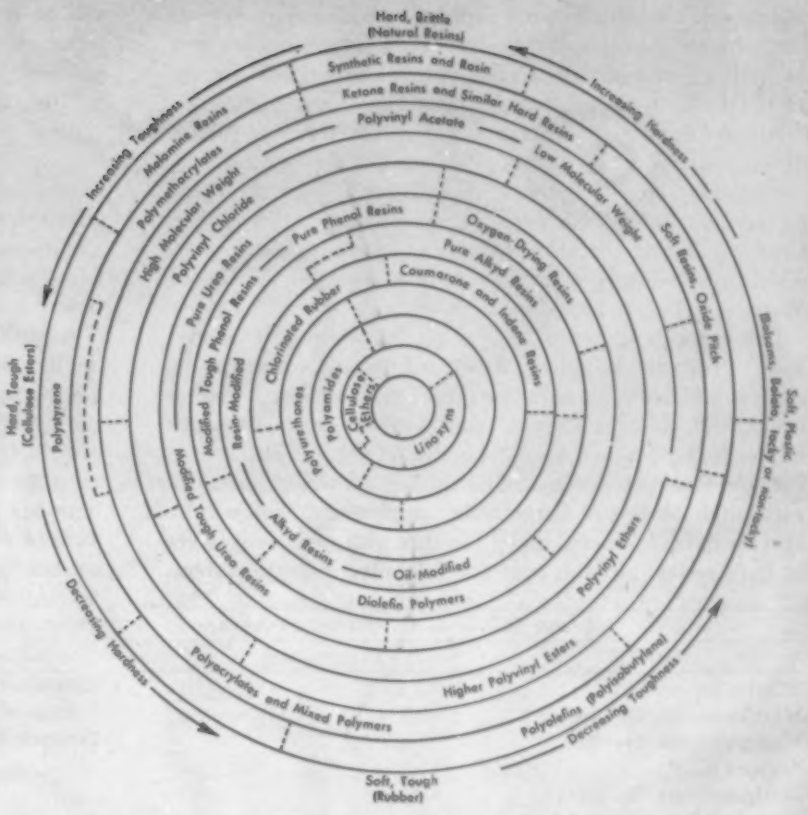
Cellulose derivatives—The sales have constantly increased and have almost reached the lacquer plan figure in spite of the scarcity of solvents, because the supply of low-boilers and aromatics has not been too bad. A decrease on account of lack of containers is to be expected. Likewise, there have been considerable increases in the production of the compounding resins—Kunstharz AP (vinylphenylketone), Kunstharz AW 2 (cyclohexanone and methylcyclohexanone), Plastopals, Uresin, Phtalopals, KM resin (rosin-glycerol-maleic) and other rosin products. These have approached the planned figures. This demonstrates the vitality of very adaptable and cheap nitrocellulose lacquers. The 10,000 tons/yr. will not likely remain sufficient, since nitrocellu-

lose lacquers can also be baked and hot-sprayed, and have proved satisfactory as coating lacquers with propylene glycol and lacquer-grade benzine as a solvent.

There is little to be said about the Cellits (cellulose acetate) because of strict rationing and insufficient expansion. While most of Cellit L is allocated for wire glass, film and plastics and the production of cable lacquer has been strongly curtailed, later on Cellit B and TP will be the more valuable products from the standpoint of the lacquer technique.

Within the cellulose ether groups, it is extremely regrettable from the lacquer industry's viewpoint that so little benzyl cellulose is produced.

The elastic urea resins have proved their manifold usefulness for oven-drying, air-drying and acid-hardening finishes. Urea resin coatings are primarily for industrial finishing. For railway and electrical applications they have displaced the phenol resins to a considerable degree. For air-drying wood varnishing (farm machinery)—partly combined with phenol resins—they have opened quite new possibilities. Their greatest disadvantage is that they contain formaldehyde and volatile formaldehyde compounds, but lately nearly odorless resins have been developed. For electrical appliances and brushing lacquers there is needed a nearly odorless "high-boiler" which is not available at this time because of the lack of glycol ethers. As a consequence of the solvent scarcity the railroads have recently started to use Plastopal (urea resin) lacquers and emulsion dyes for wood painting.



5—*Jordan's circle showing reciprocal relationships of synthetic lacquer resins*

Phenol resins—All the producers are dissatisfied with the fact that everywhere the available capacities for making phenol resins are very little utilized. There are many reasons for this. In some fields urea resins are preferred (wood, electrical, railway, nitrocellulose lacquers). An increase in their use in the metal container industry is entirely dependent on solvents (glycol ethers, butanol, alcohol). Albert G.m.b.H. has developed an extremely good resin for spray application which, if combined by the lacquer manufacturer with, for example, methacrylate resin and some Luphen (phenolic resin), will suffice for cans which are used only once. In spite of all our efforts, I. G. has not been able to produce this resin. Albert G.m.b.H. also continues to produce oil-containing products which are more compatible with hydrocarbons than the oil-free products. This shows that the market still needs types with widely divergent special properties.

Our Luphens have a steady market as coatings for cartridge cases, metal food containers, milk cans, oilproof containers, bottles and cooking utensils; they are also beginning to gain in importance for acid-proof food containers, in combination with Vinoflex PC 820 (polyvinyl chloride) and other polymers. In the coating of machinery for protection against water and chemicals, Luphen H has been gaining in importance. The interest in such phenol resin coatings, among which Atephen (phenylation) must also be included, as a substitute for metal saving alloy, is very great. Their use required large baking ovens which are either not available or have poor heat distribution. Recently, these deficiencies have been overcome after I. G. (Mr. Kopp) discovered the fundamentals of the condensation process with rising temperature.

In view of the unsatisfactory utilization of the productive capacities, all producers are looking for new products. This development has been stimulated by the fact that in airplane finishing the Russians achieved very good results with ordinary phenol resins using very simple methods; we have tried to use instead, the undoubtedly much better but more difficult to produce, Desmophen-Desmodur. The tendency to get back to primitive means and utilize the simplest reactions according to the methods of classical chemistry is unmistakable. Albert and Raschig are good examples of this. Recently Dr. W. Wolff of I. G. has developed some resins which, for the first time, are almost the same as the Albert products for food containers. Furthermore, Laro (the I. G. lacquer raw materials laboratory) was able to condense phenol with formaldehyde, especially in the form of a dialkylformal, without the use of water which had been customary. Products with interesting properties resulted: they are soluble in benzine; they do not smell of phenol or formaldehyde; and they can probably be further hydrogenated. Tests are under way to determine whether this reaction is also possible with urea, etc. Joint investigations of the ZK laboratory in Ludwigshafen and Laro resulted in the development of phenol resins

TABLE XIII.—SUMMARY OF THE GERMAN LACQUER PLAN

	t./yr.
Groups listed in Table XII	45,500
I. G. miscellaneous products	11,800
Competitors' miscellaneous products	2,300
Total synthetic resins	59,600
Natural oils	17,000
Natural resins	8,000
Total sales	84,600
Lacquer plan total	107,156
Sales in percent of lacquer plan	79%

which are compatible with ordinary plasticizers. It was furthermore discovered that only those plasticizers are of interest which react chemically with phenol resins, for example, Desavin (diphenoxyethylformal).

Alkydal lacquers—The Americans discovered that better drying could be achieved by shifting the double bonds to form conjugated systems. Later on, we will have to take advantage of this knowledge. No work has been done in this field in Germany, nor in the field of stable alkyl silicon compounds, which have recently come back into the news in the United States and England.

One other development should be mentioned particularly. The soft-plastic products, developed during recent years, some of which are chemically as reactive as the condensation resins, will give the lacquer manufacturer increasing possibilities to develop new lacquers in his old process kettles with the use of heat; for instance, from polymerized products with pitch oxide and Carbo resin, or from vinyl and acrylic acid compounds reacted under pressure with rosin derivatives or hard resins. In this way the solubility in hydrocarbons will be improved and the old desire of the lacquer manufacturers will come true, to mix in some chemistry with his processing.

Thus, it does not seem risky that the hydrocarbons are favored in the lacquer production plan; the sale of these lacquers will be less influenced by the use of hydrocarbons than by the general economic situation. We can assume that after the war the main demand will be for house construction and manufacture of furniture and other household goods, which is to a large degree wood processing and mass production of iron and metal goods. By developing a great variety of lacquer products, we will be well prepared for that task.

The emulsions, which are not included in the lacquer plan, deserve special consideration. They are well suited for use by the painting trade, although they show certain deficiencies in light fastness and other properties. Today, the Mowilith (polyvinyl acetate) dispersions seem to be the most promising; but they, as well as the Acronal (polyacrylate) dispersions, have to be further improved. The lacquer industry tries to market many emulsions of various other lacquer raw materi-

TABLE XIV.—I. G. SOLVENTS ARRANGED ACCORDING TO INCREASING EVAPORATION TIME

Material	*Composition*	*Material*	*Composition*
Ethyl ether		Ethylene glycol monomethyl ether acetate	
Methylene chloride (98/100%)		Intrasolvan E*	85% isobutyl alcohol 15% higher boiling alcohols (up to 140° C.)
Methylene chloride (tech.)			
Acetone (C. P.)			
Methyl acetate (98/100%)			
Solvent T	Tetrahydrofurane	Dioprol	Diisopropylcarbinol
Solvent E 33	75% methyl acetate 25% methanol	Anon	Cyclohexanone
		Ethylene glycol monoethyl ether	
Solvent E 14	25% methanol 60% methyl acetate (99/100%) 15% acetone	Methylanon	Methylcyclohexanone (94%)
		Ethylene glycol monoethyl ether acetate	
Solvent E 13	51% methyl acetate 25% methanol 20% ethyl acetate 4% *n*-propyl acetate	Methylanon (special)	Methyl cyclohexanone (special)
		Amyl alcohol	
		Ethylene glycol monopropyl ether	
Ethyl acetate (98/100%)			
Benzene		Intrasolvan HS*	Leuna alcohol fraction 145 to 162° C. 60% 2-methylhexanol-1 40% 2-methylpentanol-1 with small amounts of secondary alcohols
Benzine			
n-Propyl acetate			
Toluene			
Methanol			
Dioxane			
Solvent K	70% isobutyron (diisopropyl ketone) 10–20% mixed ketones (C_6–C_7) 20–10% isobutyl and amyl ketones (95% distills at 110–130° C.)	Polysolvan II S	Acetate of above Leuna alcohol fraction 145 to 162° C.
		Butoxyl	Butylene glycol monomethyl ether acetate
		Adronol acetate	Cyclohexanol acetate
		Ethyl lactate	
Alcohol 94% with 2% toluene denaturant		Pyranton A	Diacetone alcohol
		Ethylene glycol monobutyl ether	
Tamasol J	Isobutyl acetate (85%)		
Polysolvan E	Acetate of isobutyl-amyl fraction of Leuna alcohols of boiling point 120 to 140° C.	Polysolvan O	Glycolate of Leuna alcohol fraction 100 to 140° C. (principally isobutyl alcohol)
Solvenon B	1,3-butylene glycol formal		
Butyl acetate (98/100%)		Mittel L 30	85% Depanol J 15% turpentine oil II
Butyl acetate (85%)			
Amyl acetate		Solvent GC	Ethylene glycol monoacetate
Xylene		Polyethylene glycol monoethyl ether	
n-Propanol			
Isopropyl alcohol		Benzyl alcohol	
Solvalin	60% Polysolvan E 40% Polysolvan HS	Ethylene glycol	
		Depanol S 5	70% terpene alcohols $C_{10}H_{18}O$ 30% terpene hydrocarbon $C_{10}H_{16}$
Butanol			
Ethylene glycol monomethyl ether			

* Ed. Note: Inserted here by author; may not be in proper order for evaporation rate.

6—The grandeur of nature far overshadows the wrecked works of man along the Rhine

als; they are less suitable, in our opinion, and the paint trade is not very enthusiastic about them. It will, therefore, be necessary to set up specifications for high-grade products, especially for dispersions and water-in-oil emulsions of polymerized resins. Besides these, many oil-containing Alkydal (alkyd) resins and emulsions manufactured from them will be of great importance.

In conclusion, the speaker pointed out that we have good synthetic lacquer resins, but that the pigments processed with them have not shown any new development for a long time. Lead cyanamides with their stable high pH value in contrast to red lead, and the chromates, especially of the light metals (i.e., zinc tetraoxychromate = $ZnCrO_4 \cdot 4Zn(OH)_2$ in U. S. A.), open new ways as well as the works of Professor Wagner and of Degussa on lead-covered aluminum powder. Furthermore, the passive reaction of meta-nitrobenzoic acid compounds and nitrophthalic acid shows that chemically active pigments and compounding materials to increase the resistance to corrosion are of great importance even in wartime. It is, therefore, necessary to continue the investigations in the field of active pigments for protection against corrosion. With the big iron oxide plant in Uerdingen, I. G. has an interest in this field.

SOLVENTS

Solvents manufactured by I. G. are given in Table XIV.

Production development (from a report by Roth)

The speaker surveyed the development of the solvents group in three subdivisions:

1. Solvents derived from acetaldehyde.
2. Glycol ethers.
3. Chlorinated hydrocarbons.

The first group is characterized by further division into low-boiling, medium-boiling and high-boiling solvents. Group two is comprised principally of medium-boiling solvents while the chlorinated hydrocarbons are practically all low-boiling solvents with only a few in the medium-boiling group. The principal uses of the chlorinated hydrocarbons are: dry cleaning, extraction and metal cleaning.

Tables XV, XVI and XVII show the development of solvents production and sales by the I. G. as well as the allocation of acetaldehyde for solvents.

PLASTICIZERS

A list of plasticizers manufactured in Germany is given in Table XVIII. Data on production of plasticizers by I. G. are given in Tables XIX and XX. *(Please turn to next page)*

TABLE XV.—ACETALDEHYDE CONSUMPTION AT HOECHST IN 1000 TONS (INCLUDING ACETALDEHYDE IN THE FORM OF PURCHASED ACETIC ACID)

Year	*Acetaldehyde*	*Acetic acid*	*Total*
1929	20.3	1.1	21.4
1930	14.2	0.5	14.7
1931	10.4	1.4	11.8
1932	9.2	0.8	10.0
1933	10.8	1.1	11.9
1934	14.6	0.7	15.3
1935	18.4	1.9	20.3
1936	21.0	1.6	22.6
1937	26.9	0.8	27.7
1938	28.6	0.3	28.9
1939	35.2	1.0	36.2
1940	32.1	3.5	35.6
1941	37.6	5.2	42.8
1942	40.7	5.7	46.4
1943[a]	46.4	6.2	52.6

[a] Calculated on basis of January to July figures.

TABLE XVI.—I. G. SHIPMENTS OF SOLVENTS DERIVED FROM ACETALDEHYDE IN 1000 TONS (WITHOUT BUTANOL)

Solvents	*1940*	*1941*	*1942*	*1943[a]*
Low-boiling				
To customers	16.0	16.7	17.2	18.3
To Wacker	...	1.5	2.0	0.2
To I. G. plants	2.7	3.5	4.3	5.0
Total	18.7	21.7	23.5	23.5
Medium-boiling				
To customers	8.4	8.7	10.3	10.4
To Wacker	...	0.3	0.1	...
To I. G. plants	0.3	0.5	0.7	0.5
Total	8.7	9.5	11.1	10.9
High-boiling	0.5	1.2	1.9	2.8
Total for all solvents	27.9	32.4	36.5	37.2

[a] Calculated on basis of January to July figures.

TABLE XVII.—PRODUCTION OF SOLVENTS BY I. G. IN 1000 TONS

Solvents	*1940*	*1941*	*1942*	*1943[a]*
Chlorinated hydrocarbons				
Rheinfelden	6.6	8.3	11.3	13.2
Bitterfeld	8.7	9.4	9.5	10.2
Hoechst	7.1	8.5	7.9	7.7
Schkopau	...	0.5	2.5	3.5
Total	22.4	26.7	31.2	34.6
Glycol ethers (Ludwigshafen)	3.2	4.5	5.1	5.2

[a] Calculated on basis of January to June figures.

TABLE XVIII.—PLASTICIZERS FOR LACQUERS AND PLASTICS

Material	*Composition*
Albanol	1,3-Butylene glycol-diglycolate
Cetamoll Q	Trichlorethyl phosphate
Clophen 160 (A 60)	Chlorinated diphenyl (58 to 59% chlorine)
Desavin	Diphenoxyethylformal
Dellatol	Methyl butyl benzenesulfonamide
Dicyclohexyl phthalate	
ED 140	Tetrahydrofurfuryl oleate
ED 236	Thiodiglycol ester of Fischer-Tropsch forerun fatty acids (C_5–C_7)
ED 242	Same as Palatinol F
ED 356	Same as Palatinol V
Elaol I	Triester of hexanetriol and Fischer-Tropsch forerun fatty acids I (C_5–C_7)
Elaol II	Triester of hexanetriol and Fischer-Tropsch forerun fatty acids II (C_7–C_9)
Elaol III	Triester of pentaerythritol and C_5–C_7 acids
Elaol IV	Triester of pentaerythritol and C_7–C_9 acids
Hexyl phosphate	
Igevin A 25	Polyvinyl ethyl ether
Igevin A 50	Polyvinyl ethyl ether
Igevin M 40	Polyvinyl methyl ether
J 1203 M	Same as Plastomoll KF
Mannol	Ethyl acetanilide
Mesamoll	Sulfophenolates of Fischer-Tropsch hydrocarbons C_{15}–C_{18}
Mollit GH	Trimethylolpropane trichloroacetate
Palatinol A	Diethyl phthalate
Palatinol AH	Diethylhexyl phthalate
Palatinol BB (BS)	Butyl benzyl phthalate
Palatinol C	Dibutyl phthalate
Palatinol DP	Dilauryl phthalate (lauryl alcohol from cocoanut oil)
Palatinol F	Di-(C_7–C_9 Fischer-Tropsch alcohols) phthalate
Palatinol HS	Di-Intrasolvan HS alcohol phthalate (see solvents, Table XIV)
Palatinol IC	Diisobutyl phthalate
Palatinol K	Dibutoxyethyl phthalate
Palatinol L	Di-Letna alcohol phthalate
Palatinol M	Dimethyl phthalate
Palatinol O	Dimethoxyethyl phthalate
Palatinol V	Di-(C_5–C_7 Fischer-Tropsch alcohols) phthalate
Plastol C II	65–70% *p*-Toluenesulfonamide 30–35% *o*-Toluenesulfonamide
Plastol M	18.5% *p*-Toluenesulfonamide 73.0% Monoethyl *p*-toluenesulfonamide 8.5% Diethyl *p*-toluenesulfonamide
Plastol MBM	Monobutyl benzene sulfonamide
Plastomoll BMB	Butyl benzenesulfonamide
Plastomoll KF	Triethylene glycol ester of Fischer-Tropsch fatty acids (C_7–C_9)
Plastomoll TAH	Thiodibutyric diester of ethylhexyl alcohol
Plastomoll TB	Thiodibutyric diester of butylene glycol
Plastomoll TF	Tetrahydrofurfuryl alcohol ester of Fischer-Tropsch fatty acids (C_7–C_9)
Plastomoll TV	Thiodibutyric diester of Fischer–Tropsch alcohols (C_5–C_7)
Sintol T	2,6-Dimethylthianthrene
Solvoplast	Dimethylcyclohexyl oxalate
Triacetin	Glyceryl triacetate
Triacetin H	Hexanetriol triacetate
Tributyl phosphate	
Tricresyl phosphate	
Triethylene glycol capronate	
Triethylene glycol dihexoate	
Trihexyl phosphate	
Triisobutyl phosphate	
Triphenyl phosphate	
Uresin B	Condensation product of butylurethan and formaldehyde
Vulkanol B	$^1/_2$-Benzylnaphthalene
Weichmacher AG	Diethylene glycol adipate
Weichmacher ABG	Di-1,3-butylene glycol adipate
Weichmacher H1	Triglycol benzoate
Weichmacher IDP	Dodecylphenol
Weichmacher MMA	Monomethyl benzenesulfonamide
Weichmacher 12	*p*-Oxybenzoate of Fischer-Tropsch alcohols (C_8–C_7)
Weichmacher 77	Dibutyl thiodiglycolate
Weichmacher 90	Glycerol polyethylene glycol ether triacetate
Weichmacher 1044	Methylcyclohexyl stearate

Plasticizers in plastics (from a report by Kollek)

The correlation between macromolecule and plasticizer, discovered at Ludwigshafen by Kuro (the I. G. plastics laboratory) has been repeatedly discussed in Kuko circles. The work on external plasticization of high molecular substances has been intensely pursued in the light of Kuro's new discovery. The main goal of the investigations has been to find technically accessible plasticizing agents which will make possible the production of highly cold-resistant Igelit (polyvinyl chloride) materials with good electrical properties. Besides this, these efforts have been directed toward safeguarding the supply of plasticizers to meet the increased production of plastics.

It was proved in extensive experiments that some esters of thioether-carboxylic acids are Igelit plasticizers with outstanding qualities. From this series of products some have proved to be the qualitatively best Igelit plasticizers known

TABLE XIX.—I. G. PRODUCTION OF PLASTICIZERS AND CAPACITIES INCLUDING PLANNED EXPANSIONS[a]

Plasticizer group	*1940*	*1941*	*1942*	*1943*[b]	*Capacity*
	tons	*tons*	*tons*	*tons*	*tons*
Phthalates	4900	6500	8000	9300	19200
Ludwigshafen	3600	4200	4600	4500	13200
Offenbach	1300	2300	3400	4800	6000
Paraffinic sulfonates (Ue)	900	1500	2300	3200	5400
Phosphates	3800	4700	5300	5800	9500
Tricresyl (Bi)	3000	3800	4300	4800	7800
Triphenyl (Bi)	300	300	300	300	600
Cetamoll (Bi)	400	500	500	500	700
Miscellaneous (Bi)	100	100	200	200	400
Carboxylates	600	1400	2200	2200	7400
Plastikator 77 and 78 (Le)	400	800	800	800	3000
Elaol 1, 2, 12, K1 (Ue)	200	400	800	500	2400
Acetin DJ	...	100	50	50	500
Plasticizer CS (Ue)	...	100	50	50	200
Miscellaneous (Lu)	...	...	500	800	1300
Chlorinated hydrocarbons	900	1900	2500	2300	6000
Clophen (Le)	400	900	900	600	3000
Vulkanol B (Elb)	400	700	1000	900	2000
NP (Ue)	100	300	600	800	1000
Urea and urethan	167	414	840	1394	3680
Uresin B (Ho)	47	123	447	906	2180
Plasticizer 21/22 (Ho)	120	291	393	488	1440
Plasticizer BR (Ue)	...	...	...	...	60
Camphor	968	1069	1080	1124	2200
Carboxylic amides	35	49	52	42	222
Mannol (Ue)	35	40	48	28	192
Plasticizer AO (Le)	...	9	4	14	30
Sulfonamides	198	355	567	256	720
Plasticizer MMA (Le)	93	282	483	256	...
Coalin (Elb)	63	35	13	...	...
Plastomoll P (Lu)	21	25	71	...	...
Plastol C II (Lu)	21	13	...	...	...
Ethers	144	198	376	397	738
Dibenzylether (Ue)	41	92	143	178	420
Teolan P (Lu)	25	31	38	30	120
Desavin (Le)	78	75	82	69	78
Sintol T (Elb)	...	...	113	120	120
Miscellaneous	127	165	193	324	600
Albanol	63	73	70	88	120
Butyl stearate	64	42	49	22	180
Dodecylphenol (Ue)	...	50	74	214	300
Total for all plasticizers	12739	18250	23408	26337	55660

[a] Translators' Note: Because of poor legibility of the manuscript, some of the figures for individual plasticizers may be slightly in error.
[b] Calculated on basis of January to June figures.

TABLE XX.—SUMMARY OF CARBOXYLATE PLASTICIZER PRODUCTION AT LUDWIGSHAFEN

Plasticizer	*Production in tons*					
	1940	*1941*	*1942*	*1st half 1943*	*1st quarter 1943*	*2nd quarter 1943*
Weichmacher 90	...	...	...	...	...	...
Elaol III	...	...	40.0	36.1	25.7	10.4
Elaol IV	...	...	22.0	...	...	...
Plastomoll KF	0.7	18.3	271.5	217.7	...	...
Weichmacher H 1	45.7	16.6	3.7	1.2	...	1.2
Plastomoll TF	...	...	...	1.0	1.0	?
Plastomoll TV	...	0.5	65.2	39.3	...	...
Plastomoll TB	...	...	1.0	2.1	2.1	?
Plastomoll BS	...	...	1.1	8.2	...	...
Plastomoll TAH	...	...	...	2.0	2.0	?
Plastikator 89	...	...	4.8	3.2	3.2	?
Plastikator 89 ex.	...	...	6.1	7.6	7.6	?
Weichmacher 1044	11.9	26.4	...	2.8	2.8	?
Plastol LB	0.7	25.6	86.5	18.1	18.1	?
Weichmacher P 5	...	...	14.0	...	...	...
Plastomoll BMB	...	...	...	...	...	...
Total	59.0	87.4	515.9	339.3		
	Estimated additions			33.7		
				373.0 times 2 = 746.0 in 1943		

at present. Plastomoll TV and TAH, two products which have been produced and marketed for some time, are the most important. Both products have proved to be so excellent, as was to be expected from the laboratory tests, that it is highly desirable that greater quantities be made available. Besides these two Plastomolls, certain other products have been found to be excellent Igelit plasticizers, but it is totally impossible to manufacture them because of the raw material situation.

The present demand for plasticizers for plastics is as follows: With a production of 1500 to 1600 t./mo. of Igelit (polyvinyl chlorides), 1000 t./mo. of Mowilith D (polyvinyl acetates), and 700 t./mo. of Acronals (polyacrylates), and by Wacker of about 250 t./mo. of Vinnol (polyvinyl chloride) and about 300 t./mo. of Vinnapas D (polyvinyl acetate) the demand for plasticizers for plastics will amount to 1300 to 1400 t./mo., of which at least 300 to 350 t./mo. must be especially high-grade products.

The demand for plasticizers of medium quality is met by the production of tricresyl phosphate in Bitterfeld, Mesamoll (paraffinic sulfophenolates) in Merseburg, and certain Palatinols (phthalates) in Offenbach and Ludwigshafen. On the other hand, the necessary minimum demand for high-grade plasticizers is by no means secure. They have been mainly based on Fischer-Tropsch forerun fatty acids and, contrary to all previous plans and estimates, the quantities of forerun fatty acids allocated to plasticizers will not be increased but rather according to recent hints from the Reichsstelle Chemie will be decreased. Since a certain minimum of high-grade plasticizers cannot be given up because of the very important and very specialized use of Igelit plastics, it is important to take advantage of all possibilities for making high-grade plasticizers which are not dependent on forerun fatty acids. Investigations in this direction, jointly undertaken by different places, resulted in the discovery that the following acids and alcohols might yield high-grade plasticizers.

Acids: γ,γ-thiodibutyric acid
oxydibutyric acid
butoxyacetic acid

Alcohols: ethylhexanol
oxyalcohols from Leuna
UV-alcohols from Oppau

Lacquer plasticizers (from a report by Jordan)

Since the lacquer plan was made, the sales of plasticizers has considerably increased and almost doubled. But their increase has not been as great as the increase in sales of the hard-tough lacquer bases requiring plasticizers, especially nitrocellulose.

The reason for this is that during the last few years the lacquer manufacturers have had at their disposal a great variety of soft resins and other soft-plastic products. Formerly, nitrocellulose was mainly processed with hard resins and liquid plasticizers and required enormous quantities of plasticizers. Today, in several fields, nitrocellulose is combined with soft-plastic products, such as RD-Alkydal, Uresin, Plastopal-A resins and Phtalopals. In such cases the demand for liquid plasticizers is often a little smaller, although they have not become superfluous. *(Please turn to next page)*

7—This is London. Not all the wreckage of this war is in Germany. 8—A molding shop of Dynamit A.-G. at Troisdorf

7

8

9—Resin-impregnated paper preforms used to mold battery containers at Troisdorf for use on German subs

Through this development also, the plasticizers formerly called non-gelatinizing and today called "non-solvent," their prototype being castor oil, are losing considerably in importance. Leather lacquers and nitrocellulose artificial leather are important exceptions.

Today's variety of liquid plasticizers is sufficient for wartime. The most important types are the phthalates and phosphates, supplemented by some other esters, especially the adipates. The use of Mesamoll and Solvoplast (dimethylcyclohexyl oxalate made in Aussig-Falkenau) is mostly for emergency purposes.

The properties of the plasticizers available today are in the long run unsatisfactory for important fields of use, especially with respect to cold resistance, heat aging and sometimes volatility. Some valuable new products for special purposes, such as for imparting fuel- and benzine-resistance as well as aging stability in Cellit lacquer, have been developed.

During recent years more new plasticizers have been investigated than products of any other group. The yield has been extremely poor. In some cases the products were only of interest because they could be quickly produced from raw materials which had not been completely exhausted. Such products will disappear later on. Only the following groups are of significance:

Esters of *β,β- and γ,γ-thiodibutyric acid* with higher alcohols, especially with ethylhexanol.

Esters of the *sulfodibutyric acids* are of interest in special cases (fuel resistance): esters of the oxydibutyric acid are of some value.

Some of the esters of tetrahydrofurfuryl alcohol are remarkable for their very good solvent power and low volatility (Plastomoll TF for Cellit).

Still uncertain is the value of the *mixed esters* of dicarboxylic acids, which also contain one or more hydroxyl groups and which are remarkable for their cold-resistance (Esterols made at Leuna). They constitute a link with soft resins field.

Of certain interest for special uses are the plasticizers containing strong van der Waals' forces in the molecule; for example, Plastol MBM (butyl benzenesulfonamide) and Dellatol (methyl butyl benzenesulfonamide). The influence of *nitrogen, sulfur* and *silicon* in plasticizers has been but slightly investigated. Liquid *monourethan* is being investigated; the Sintols (thianthrenes) with sulfur in the molecule have a lasting value for benzylcellulose and lacquer bases containing chlorine, used for protection against moisture. The development of the Clophens (chlorinated diphenyls) has led to more resinous type products. Pure hydrocarbons are of hardly any interest.

Summarizing, it can be stated that by enlarging our intermediates by thio- and sulfodibutyric acids, ethylhexanol, tetrahydrofurfuryl alcohol and the various polyalcohols, we have obtained a complementary and versatile range of plasticizers which can be readily adjusted to the changing demands of the consumers and also to a peacetime economy.

The scientific studies of plasticizers, recently started to evaluate the new theoretical knowledge, will lead to the cultivation of new types of plasticizers. For lacquers this will be more difficult because the plasticizer is often used in two-component systems—e.g., in combinations of nitrocellulose and hard or soft resins—and these materials have a great variety of properties. In plastics, on the other hand, frequently only *one* plastic is compounded with *one* plasticizer.

Plastics Production (from Report by Alt)

Table XXI shows the development of the production of plastics during the last few years. Nearly all types had a steady increase; only the acrylates show a slight decrease because an insufficient allocation of ethylene oxide did not allow the full utilization of the available capacities.

The requirements for Igamids are much higher than listed in Table XXII, especially that for Igamid U. If we get enough manpower, the probable production in the not too distant future may be approximately as follows:

500 t./mo. of Igamid B	
100 t./mo. of Igamid A	
100 t./mo. of Igamid U	
700 t./mo. of Igamids	

Plastics Research (from Report by Kollek)

Aqueous plastic dispersions

Mowilith D (*Polyvinyl acetates*)—The Mowilith D products continued to show outstanding success as compounding ingredients for fibrous, coating and adhesive materials. The new type Mowilith D 64 (70 percent plasticizer) has contributed to this favorable development.

The Mowilith D types are limited in their application. They are not suitable for impregnated-fiber artificial leather products on account of their moderate cold resistance, their relatively high hardness, their unfavorable processing characteristics and low resistance to splitting and tearing of the finished products, nor for the production of coating materials on account of their unsatisfactory cold resistance and the difficulty in preventing the migration of plasticizers.

In the new types Mowilith DV and Mowilith DV 32, in which sodium vinylsulfonate is used as an emulsifier, the particle size has been reduced to less than 0.1 μ (as compared to a particle size for the other Mowilith D types of up to 2 μ). In this way it may become possible to use the Mowiliths also for the artificial leather products. Practical tests with these two new products are underway.

TABLE XXI.—PRODUCTION OF PLASTICS BY I. G.

Material	*1937*	*1938*	*1939*	*1940*	*1941*	*1942*	*1943*[a]
	t./mo.	*t./mo.*	*t./mo.*	*t./mo.*	*t./mo.*	*t./mo.*	*t./mo.*
Igelits, total	66	124	326	806	1181	1482	1734
PCU (polyvinyl chloride)	35	81	230	636	915	1234	1497
Bitterfeld	35	81	230	499	739	973	1131
Schkopau	..	...	...	137	176	179	208
Ludwigshafen	..	...	...	...	...	82	158
PC (chlorinated PVC)	..	...	15	43	78	80	88
MP (mixed polymers)	31	43	81	127	188	168	149
Acronals (polyacrylates)							
Block and solution polymers	..	8	19	52	61	56	49
Dispersions (including water)	67	105	407	671	755	756	675
Mowiliths (polyvinyl acetates)							
Block and solution polymers	25	18	25	65	136	190	191
Dispersions (including water)	20	44	137	277	536	840	955
Polystyrene, total	34	71	140	297	368	447	493
III, IV, L	34	66	128	265	359	383	389
EF	..	5	12	32	9	64	104
Oppanol B (polyisobutylene)	16	36	92	233	369	414	379
Polyvinyl ethers, total	..	44	61	161	266	319	315
Igevins	..	36	44	130	209	263	244
Oppanol C (polyvinyl isobutyl ether)	..	8	17	31	57	56	71

[a] Calculated on basis of January–September figures. Note that figures are on monthly basis; to obtain annual production multiply by 12. It is assumed that the figures are in metric tons; 1 metric ton equals approximately 2205 pounds.

The normal plasticized Mowilith D types contain tricresyl phosphate as plasticizer. Lately, a type without tricresyl phosphate has been brought on the market under the name of Mowilith D 300 LM. This is a copolymer consisting of 70 parts of vinyl acetate and 30 parts of vinyl chloride, plasticized with Palatinols V and C (see Table XVIII). This tricresyl-phosphate-free dispersion is to be used for impregnation of materials which come into contact with food.

Acronal D (polyacrylates)—Application research with Acronals was mainly concerned with the elimination of difficulties in working in order to improve the quality of the finished products. Acronal II DP was developed as a paste suitable for coating purposes without the addition of thickening agents. It is distinguished from the normal types especially by its high water resistance and is to be used in the fields of coating and creping. Promising research is also under way to produce Acronals 450 D, 500 D and 550 D in paste form.

Improvement of strength properties, especially wet strength, was investigated. By incorporating reactive groups into the Acronal molecule, products have been obtained which react further on subsequent treatment with bifunctional compounds. This cross-linking results in deep-seated changes in the film properties. The incorporation of reactive groups was achieved by:

1. Copolymerization with compounds containing chlorine in side chains and subsequent saponification.
2. Copolymerization with allyl alcohol.
3. Copolymerization with acrylic or methacrylic amides.

The experiments in which acrylic amide was incorporated were especially favorable. Products were obtained which showed a much higher tensile, stitch-tear and cracking resistance without decrease in extensibility. The experience gained in this research will now be transferred on a much broader basis to various polymers, including copolymers containing diolefins.

Bifunctional compounds available in the field of plastics are as follows:

Pollon I—a 50 percent aqueous solution of a condensation product of melamine, formaldehyde and ethylene glycol.

Gerlon I—a product of the reaction of oxalic ester and ethyleneimine.

Gerlon II—a product of the reaction of tolylenediisocyanate and ethyleneimine. *(Please turn to next page)*

10—*Two other types of phenolic-paper battery containers. One on left is molded in one piece (without partitions); one in center is assembled from two of the molded parts which are shown immediately to the right of the assembly*

TABLE XXII.—IGAMID PRODUCTION PLAN (END OF 1943)

Application / Product	Total used	Type A (adipic acid; hexamethylenediamine)	Type B (caprolactam)	Type U (1,6-hexanediisocyanate; 1,4-butanediol)
	t./mo.	t./mo.	t./mo.	t./mo.
Artificial silk	53	10	43	...
Fibers	25	10	14	1
Bristles	145	...	129	16
Lyafol (film)	90	54	36	...
Perfol (film)	8	...	8	...
Injection molding	26	16	10	...
Artificial leather	36	22	14	...
Belting (industrial)	30	...	30	...
Totals	413	112	284	17

Promising research in several directions is under way with these products.

In order to improve the fiber-binding action of Acronal 450 D, a new formula has been worked out consisting of a copolymer of 50 parts of ethyl acrylate and 50 parts of vinyl acetate. By marketing this type, the former type of Acronal 450 D as well as 400 D become superfluous.

By using certain emulsifying agents, Acronal dispersions with positive charges were successfully produced. It is to be expected that they will become attached substantively on the fibers in the production of pressed fibrous products and that in this way it will be possible to achieve a better fiber binding.

Aqueous Igelit (polyvinyl chloride) dispersions—After extensive preliminary work an aqueous dispersion of polyvinyl chloride (approximately 55 percent) with Palatinol HS as plasticizer has been brought out under the name of Igelit D 10. The preliminary test results indicate that the product has remarkably good prospects for use in the field of coating materials.

Oppanol B (polyisobutylene) dispersions—The Oppanol B I dispersion used up to now has a very low viscosity and must be thickened for coating purposes. Stimulated by a development of the firm "Koetitzer Ledertuch- und Wachstuchwerke" (Koetitzer works for artificial leather and oil cloth) a new Oppanol B dispersion in the form of a coating paste has been brought on the market for the production of anti-gas products; it has been well received by all firms in this business who have tested it.

Igelits (polyvinyl chlorides)

In all fields where Igelits are used there has been an increasing demand for them. Considering the application possibilities, it is very regrettable that the present production capacities cannot be utilized due to lack of raw materials and manpower. The deficiencies in the quality of Igelit PCU, resulting mainly from inadequate processing, still have not been removed. As far as the manufacture of the different types is concerned, it must be remembered that Schkopau can produce a perfect Igelit K. Furthermore, it can produce very good waterproof types.

The "impact-press process" developed in Bitterfeld offers very great possibilities for further widening of the applications of Igelits. The change from Ampho soap to the emulsifier MK has resulted in considerable fluctuation in the quality of Igelit MP.

Oppanols (polyolefins)

A series of new Oppanols has been brought out, as follows:

Oppanol BU 1
Oppanol BU 01
Oppanol BU 05
Oppanol BU 005

These consist of polyisobutylene cross-linked with the corresponding quantities of *p*-divinylbenzene to produce more stable mixtures.

Oppanol V is Oppanol B 50 in which 1 percent of isoprene and 0.1 percent of *p*-divinylbenzene are copolymerized. It can be vulcanized and yields compounds which are more stable and more resistant to abrasion and solvents than the normal Oppanol B. It is of importance because it is more easily soluble after mastication and quantities of solvents can be saved in making coating materials for anti-gas products.

Oppanol K is a polypropylene with excellent properties as a cable insulating oil.

Polystyrenes

Injection molding machines are now in operation for the production of printing type from polystyrene EN (copolymer of 70 parts styrene and 30 parts acrylonitrile) and there has thus developed a permanent demand for polystyrene EN which will not exceed a few tons per month.

Igamids (polyamides)

With the production of Igamids ULW 25, ULW 15 and UL the development of Igamids is finished for the time being. A thorough research will be necessary now to determine correctly the proper applications for the Igamids. As before, there remain many demands for improvement; the most important is a considerable improvement of the cold resistance in the field of leather substitutes.

Lupolen (polyethylene)

The production of Lupolen H with a molecular weight of about 20,000 has been undertaken. The product produced in the experimental plant in Ludwigshafen is thought to have very good properties and has great market possibilities for:

1. High frequency insulation.
2. Cables, especially for sea cables as a substitute for gutta percha and for high tension line cables as a solid insulating material in place of oil.
3. Protection against corrosion.
4. Packings.
5. Combinations with Oppanol B.
6. Impregnations of all kinds.

Desmophen-Desmodur (polyurethanes)

Here the further development has been very promising for several fields of application. The products can be handled under more practical conditions in the plant with the development of the physiologically less harmful brands: Desmodur HH, TH and TT. The most promising uses for the Desmophen-Desmodur combinations are in the direction of the production of coatings, anti-gas products, adhesives, packings and putties, and foamed materials.

To overcome the wet cracking of Igamid 6A, a new triisocyanate, under the name of Desmodur DR, was developed which has great processing advantages over the Desmodur brands used for this purpose so far. (The chemical identity of the Desmodurs is given on page 152F of the October 1945 issue of MODERN PLASTICS. Desmodur TT is made with 3 mols of Desmodur T and 1 mol of trimethylolpropane.)

Cellular plastics in aircraft

by CARROL C. SACHS*

THE design and fabrication of high-performance military airplanes have repeatedly undergone basic changes in the airframe or load-carrying structure. With the advent of the stressed skin type of structure, the old phenomenon of compression buckling took on a new significance.[1] As stronger light metals became available, the skin gages were repeatedly reduced until failure by compression buckling became of first order importance to the aeronautical engineer.

One of the immediate things which could be done to alleviate skin buckling was to provide periodically spaced stiffeners. This effectively decreased the panel size along which the compression load must act. However, as design loads increase in magnitude, the type of critical failure remains the same—that is, compression buckling—except on a smaller panel. Where weight is an important factor in performance, as in airplane design, there is obviously a limit to the number of stiffeners which are practical.

Another method of stabilizing the skins of airplanes against compression buckling is through the adhesive attachment of a supporting core of rigid cellular plastic of low specific gravity. It is believed that this method offers both savings in weight and simplicity in fabrication. The application should begin on lightly loaded parts such as cabin partitions, trim tabs and the trailing edge of the wing. As both cellular materials and fabrication techniques develop, the application to fuselage panels and the leading edge of the wing would logically follow.

Many new cellular boards have been developed recently. Without doubt, countless others will emerge from the laboratories. Most of these cellular boards are not new synthetic resins but rather are older materials converted into a new form. To assist the engineer in the visualization of how some of the cellular boards are produced, a few of the manufacturing techniques have been organized and are presented in Table II. Most of these techniques have been borrowed from the rubber industry which has long produced both elastic and hard rubber sponges.

Thermoplastic foams

The various types of thermoplastic cellular materials are best catalogued on the basis of the type and characteristics of the blowing agent used in their manufacture. Blowing agents are required to produce the cells in the plastic material and may be of the following types: 1) solid yielding gas, 2) solvents, and 3) soluble gas under pressure.

The oldest form of blowing agent is that of using a solid which will yield a gas. Probably the most classical example of this type of blowing is in the baking of biscuits or cakes. Either sodium carbonate or bicarbonate may be used, since both yield carbon dioxide gas upon decomposition. A somewhat lower temperature may be employed, particularly when moisture is present, providing an organic acid such as tartaric acid or fumaric acid is present. This system yields carbonic acid which in turn decomposes into carbon dioxide gas and water vapor. Prolonged heating not only yields carbon dioxide but, as the temperature rises, causes the internal pressure to increase so that cell formation is facilitated.

All of the common thermoplastics may be converted into cellular materials by means of the carbonate blowing agents. Among these may be included cellulose acetate and acetate butyrate, the vinyl esters and ethers, styrene, the acrylates and methacrylates and ethyl cellulose. Vinyl acetal and vinyl chloride cellular boards have been produced in England.

Handling of thermoplastic foams

Each resin must be handled in a particular manner to obtain blowing in the proper portion of the viscosity-temperature curve where the resin is soft enough to be expanded by the carbon dioxide gas liberated, but not sufficiently fluid to allow the walls of the individual cells to break through and coalesce. In other words, the resin must be capable of "holding" the gas if small uniform cells are to be obtained. The final size of each cell is dependent upon the crystal size of the blowing agent used and the stress release temperature of the resin. The particles of blowing agent must be uniformly distributed within the resin since two particles adjacent to one another result in a double-sized cell. This thorough mixing and distribution is generally achieved on hot mill rolls or in a Banbury mixer. Since the blowing agent must be introduced into the resin while the latter is in a softened or plasticized state, critical temperature control is necessary at this stage to avoid premature decomposition of the blowing agent.

After the blowing agent has been fixed in the resin, the compound may be expanded by any one of several methods. First, the compound may be introduced into a fully positive compression mold which is equipped for both heating and cooling. The charge is heated with full molding pressure applied, and, after the temperature has raised sufficient to plasticize the mass and discharge the blowing agent, the piston or force is backed slowly out of the mold cavity. The gas which has been compressed expands, thereby forming the cellular structure. The mold is then cooled by circulating cooling water through the chase after which the charge is ejected. If sheet stock is being formed in this manner, fabric such as canvas or glass fiber may be layed into the mold under the charge and an adhesive bond will be accomplished during the blowing operation.

A second method of producing continuous cellular strip stock is by processing the compound through a mechanical extrusion screw press where the resin is plasticized and the blowing agent is decomposed after which the foam is shaped by extrusion through a rectangular die. The cellular strip stock is cooled on an endless conveyor belt, after which it may be cut to the appropriate length for shipment. Needless to say, the shipment of materials having a specific gravity as low as 0.5 to 5.0 lb. per cu. ft. offers problems of its own.

A third method of expanding cellular plastic material consists of placing the charge between two sheets of aluminum which act as output electrodes to an ultra high-frequency oscil-

* Consulting engineer.

[1] Compression buckling can be visualized by the following demonstration. When a sheet of paper is grasped by either end and pulled in tension, the paper aligns itself as it becomes taut and remains in alignment until the actual tensile failure of the sheet occurs. This is not the case when pushing inward on opposite ends of a sheet of paper. Long before compression failure occurs, the sheet buckles outward to one side or the other, the net result being a configuration failure rather than a material failure in compression. After compression buckling occurs, the sheet cannot effectively carry compression loads. Doubtless all those who have ridden in a modern airliner have noticed this phenomenon on the upper surface of the wing where it is referred to as "oil canning." One of the costly results of such oil canning is a premature fatigue failure of the parts involved.

TABLE I.—PHYSICAL DATA ON EXPERIMENTALLY AVAILABLE CELLULAR BOARDS

Properties	*Cellulose acetate*	*Polystyrene*		*Phenol-formaldehyde*		*Buna S rubber*		*Polyvinyl chloride*	*Polyvinyl formal*	*Styrene polyester copolymer*
Density, lb./cu. ft.	4–9	1.5–2.0	5–7	2–5	7–10	4.5	9	10–20	6–30	20–30
Standard sizes	Strip 3½ in. × ⅛ in. to 10 ft.[a]	3 × 10 × 30 in. 2 × 10 × 30 in. 3 × 8 × 30 in. 2 × 8 × 30 in.		[c]	Up to 25 × 25 × 2 in.	3 ft. × 3 ft. × 1 in.	3 ft. × 3 ft. × 1 or 2 in.	2 ft. × 1 ft. × ½ or ⅜ in.	3 ft. × 2 ft. × ½ or ⅛ in.	1 ft. × 1 ft. × 1 in.
Producer	Du Pont	Dow Chemical Co.		General Electric		U. S. Rubber		Expanded Rubber Co., Ltd.	Expanded Rubber Co., Ltd.	Bakelite
Thermal conductivity, Btu.	0.30	0.25–0.27		0.24	0.26	0.237	0.240	...	0.24	0.30
Maximum working temperature	150° C.	80° C. 176° F.		150–200° C. 302–392° F.		60° C. 140° F.	93° C. 200° F.	65° C. 149° F.	70–80° C. 158–176° F.	120° C. 248° F.
Flammability, in./-min.	8.5 to 3.7	Burns slowly		Does not burn		Burns		Varies with plasticizer	Burns slowly	Burns
Compression strength, p.s.i.	75–300	20–40 at yield pt.	110–200	10–30	100	50–80	237	...	170	...
Tensile strength, p.s.i.	77° F:95–310 170° F:95–235	40–80	200–350	5–35	80	72	110	...	340	...
Modulus of elasticity										
Compression p.s.i.	3500–1350°	850	7000–10,000	100–550	2500	...	...	...	...	...
Tension p.s.i.	...	700	7500–11,000	...	...	2800	3300	...	10,000	...
Impact strength, ft.-lb.	0.04–0.2	1.5[b]	6–14	0.005–0.01	0.1–0.3	3.0	6.5	...	2.46–3.70	0.5–1.5
Moisture absorption										
50 percent R.H.	0.1–0.2 lb./cu. ft.	...		...	...	...	...	...	...	...
100 percent R.H.	0.5–0.9 lb./cu. ft.	...		...	...	...	...	...	...	...
Total immersion	5–4.5 lb./cu. ft. in 24 hr.	50 percent (surface only)		...	...	3.5 percent 10 days	17 percent 100 days	...	...	...
Relative cost/board ft., 5 lb. cu. ft.	$0.90 lb.[a]	...		...		$0.29	...	...	...	$.375

[a] Sizes and price applies to experimental production; commercial sizes and prices have not been determined.
[b] Unnotched Izod (⅝ × ½-in. specimen).
[c] Since low density foam need only be confined during foaming by an easily fabricated sheet metal or plywood form and since no heat or pressure is required, little limitation on shape or size exists.

lator. The electrodes may be surface treated in such a manner as to cause the expanding cellular core to adhere in the instances where a sandwich structure is found highly desirable.

The fourth method of blowing cellular materials consists of milling into the compound a small percentage of acetylene black in addition to the blowing agent. This will give a high resistance having sufficient conductivity to provide for resistance heating at 110 v. and 60 cycles.

Another solid blowing agent yielding a gas comprises the group of diazo compounds which thermally decompose yielding nitrogen gas. One example of this family of blowing agents is diazoaminobenzene.

Thermoplastic resins may be masticated in a Banbury mixer or on heated rolls, and blended with a small amount of polymerizable or non-polymerizable solvent. After sheeting on the mill, the stock is cured or aged to the proper solvent content after which it may be expanded by any of the above methods. A small amount of catalyst is also used if the liquid blowing agent is capable of polymerization. As the temperature raises, the vapor pressure of the blowing agent increases and, upon release of the molding pressure, forms cells in the resin. In time the small amount of liquid present polymerizes to become part of the cellular board.

The last method to be described here for expanding thermoplastic materials into cellular form consists of dissolving a soluble gas under pressure into a partially polymerized resin monomer (syrupy). As the resin is further polymerized, the pressure is released and the gas allowed to come out of solution forming the desired cellular structure.

Thermosetting foams

Most thermosetting materials polymerize by the process of condensation polymerization, i.e., they become resinous by splitting out a small molecule of by-product from the two reactants. This condensate, usually water, may be vaporized to steam and utilized as a blowing agent either directly or acting indirectly upon some additive such as calcium carbide to yield acetylene gas. Phenol, urea and furfural formaldehydes have been blown into cellular form. Thermosetting cellular boards are notably deficient in impact strength, normally being quite brittle. Unlike the thermoplastic cellular boards, the thermosetting foams cannot be easily reformed. Hence, they are generally formed to the final shape during the blowing operation. Advantageous properties include higher temperature resistance and a higher modulus of elasticity.

Copolymer foams

Outstanding among the copolymer resins are the styrene polyester copolymers which may be converted into cellular form without the use of pressure. The standard method for producing cellular board is to catalyze the resin, mix in the blowing agent and expand in a mold consisting of two sheets of plate glass separated a suitable distance by a polyvinyl chloride gasket about the periphery. (*Please turn to next page*)

TABLE II.—PRODUCTION SCHEME FOR RIGID PLASTIC CELLULAR MATERIALS

Thermoplastics		
Solvent blowing agents	nonpolymerizable solvent (ethers, esters, aromatics, aliphatics, alcohols, water) + resin → Masticate on hot mill or Banbury mixer → age	(1) heat in *wet*, fully positive compression mold, (2) extrude on screw press or (3) blow using R. F. current or acetylene black at low frequency → cool → eject.
	polymerizable solvent (monomers of acrylates, methacrylates, styrenes, allyl esters, vinyl acetate, polyhydrocarbons, etc.) + catalyst + resin → hot mill or Banbury mixer → age	
Solid yielding gas	carbon dioxide gas. — resin + sodium carbonate or bicarbonate + tartaric acid, aluminum sulfate or monocalcium phosphate → hot mill or Banbury mixer	
	nitrogen gas.—resin + diazoaminobenzene → hot mill or Banbury mixer	
Soluble gas under pressure	acetylene + styrene monomer or bodied polymer + pressure + catalyst in steam-jacketed autoclave	(1) heat → release pressure allowing dissolved gas to come out of solution → cool → eject.
Reaction condensation	water vapor.—phenolic or urea resin only partially condensed, or glycols and anhydrides or monobasic acids	(1) heat → condensation + condensate → heat → H_2O vapor → eject hot (2) acid → exothermic heat → ibid.
	alcohols.—tetraortho silicate esters, silicon tetrachloride + glycols	
	ammonia.—diamines	(1) heat → cool.
Copolymers		
Solid yielding gas	Carbon dioxide.—styrene polyester copolymer + catalyst + sodium bicarbonate + acid in two glass plate sheet mold	(1) wet all surfaces of sheet mold with resin for uniform "climb," bake in oven at 175 to 300° F.
	nitrogen.—styrene-butadiene copolymer + diazoamino benzene	(1) heat in positive compression mold → cool → eject.
Monomer vapor	vinyl acetate.—styrene polyester copolymer resin + catalyst + vinyl acetate monomer	(1) heat to cure → vinyl acetate vaporizes due to low boiling point → cool → eject.

° Since low density foam need only be confined during foaming by an easily fabricated sheet metal or plywood form and since no heat or pressure is required, little limitation on shape or size exists.

In order to make the resin "climb" it is essential that the entire interior surface of the mold be wet with the resin before placing the mold in an oven for the cure and blowing. In the past, styrene polyester copolymer cellular boards have been quite brittle. However, the use of new internal plasticizers, which are copolymerized simultaneously, now make it possible to obtain any rigidity in cellular board from a brittle to a rubbery texture.

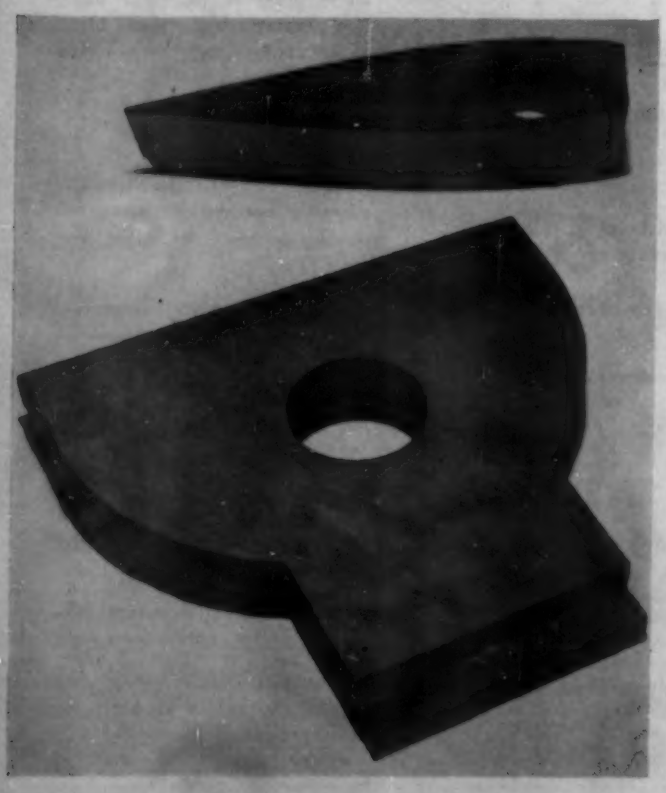
Physical properties of cellular materials

It should be emphasized that most of the cellular plastics are still only laboratory pilot plant operations and a need exists for standardization of the products and reliable engineering data to facilitate their application to the airplane and industry. Some of the physical properties of cellular plastic materials available from the literature, supplemented by various laboratory tests, are presented for study on page 174 in Table I.

Where a range of density is indicated, the data given apply only to the lowest density. As can be seen, all of the plastics listed compare in specific gravity to balsa wood. As a matter of fact, cellular plastics have been given considerable developmental attention largely because of the shortage of balsa wood during the early part of this war. Since balsa wood weighs from 8 to 15 lb. per cu. ft., it can be seen that cellular polystyrene or urea formaldehyde, both of which have been prepared in $1^1/_2$ lb. per cu. ft. density, far surpass the natural material on a straight density basis.

It is notable that when cellular cellulose acetate is expanded in a compression mold the cells can be made to lie parallel to the movement of the plunger, thus simulating directional grain as found in balsa wood. Some samples tested have as much as four times the ultimate compressive strength with the grain as across the grain in cellular cellulose acetate. Hence, it can be seen that the need for adequate specifications was necessary.

Samples of shapes into which cellular rubber can be molded



Cellular boards in sandwich construction

Cellular boards of the various plastics can be adhesively attached to high-strength skins on either face forming structural or load-carrying sandwiches. It might be pointed out that the entire fuselage of the Mosquito bomber consisted of such a sandwich—a balsa wood core separating aircraft spruce skins. Among the various adhesives used to bond skins to core, the furane resins are outstanding.

Within the furane family are found cements which will adhere to metal, wood and nearly every type of cellular plastic. Bonds can be obtained at low bonding pressure—lead shot bags being frequently used in laboratory. Special accelerators make it possible to cure the thermosetting cement without the application of heat. The styrene polyester copolymer resins and Nylon 6 and 8 have likewise been found of value in bonding structural sandwiches.

In addition to forming a structure which is excellent in compression loading, sandwiches containing synthetic cellular cores are light in weight and possess excellent heat and sound insulating qualities. Since a cellular core supports the skins at all points over the surface area, sandwich type structure when used in airplane partitions, tables, etc., gives the feeling of being substantial. This feeling is so frequently lacking in thin gage metal-stiffener type wall structures.

Conclusions

Every class of synthetic resin polymer has been converted into cellular form. However, as mentioned previously, most of the cellular boards are at present available only from pilot plant operations. Plastic cellular boards possess very low specific gravity and excellent heat and sound insulating qualities in addition to having physical properties comparable to balsa wood. The chemical properties and uniformity obtainable should enable this form of plastic material to be used to good advantage in many airplane structural applications. The possibility of utilizing cellular boards as core material for structural sandwich construction should result in saving of weight and in fabrication simplicity.

References

Wm. Kuch, "New Research on the Use of Hardening Plastics for Aircraft Construction," Journal Royal Aeronautical Society *XLIV*, 44 (Jan. 1940).

Williams, Leggett and Hopkins, "Flat Sandwich Panels Under Compressive End Loads," Report No. A. D. 3174, R. A. C. No. 5186 (June 1941).

Leggett and Hopkins, "Sandwich Panels and Cylinders Under Compressive End Loads," Report No. S. M. E. 3203, Royal Aircraft Estab.

"Cycleweld Bonded Laminated Aluminum Alloy Plate Material," Materiel Command Report No. Eng.-51-45324-5 (May 26, 1943).

"Plastic Four-wheeled Passenger Van," The Engineer (British) 188 (March 10, 1944).

"Metal Plus Plastics Makes New Aircraft Flooring," Aviation 130 (April 1944) (Panelyte with metal strips in nodes of corrugation.)

J. M. Gerschler, "Sandwich Combinations for Aircraft Structures," Letter to Commanding General AAF Materiel Command, Wright Field, Dayton, Ohio (June 19, 1944), Lockheed Aircraft Corp.

"Application of Glass Laminates to Aircraft," Modern Plastics *21*, 98 (May 1944). (Balsa core-Fiberglas faced sandwich structures.)

"Expanded Plastics," British Plastics, *16*, 63 (Feb. 1944).

"Evaluation of Sandwich Combinations for Aircraft Structures," Materiel Command Memorandum Serial No. Eng.-51-45119-1-2 (Feb. 15, 1944). (Balsa core with Fiberglas and aluminum skins.)

P. Schidrowitz and C. A. Redfarn, "Expanded Chlorinated Rubber," Journal of the Society of the Chemical Industry (British) *LIV*, No. 32 (Aug. 9, 1935).

"Results of Some Tests on Low-Density Materials," Forrest Products Laboratory (July 1944).

"Plastics Sandwich," Plastics and Resins 15 (Sept. 1944).

"Structural Composite Plastic Materials," Modern Plastics *22*, 133 (Sept. 1944).

W. J. Kommers, "Flexural Rigidity of a Rectangular Strip of Sandwich Construction," Forrest Products Laboratory (July 1944).

J. Delmonte, "A New Way of Using Old Materials," Modern Plastics *22*, 95 (April 1945).

"Data on Material Properties and Panel Compressive Strength of Plastic-Bonded Material of Glass Cloth & Canvas," NACA Technical Note No. 975 (Dec. 1944).

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PLASTICS DIGEST

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

HUGHES FLYING BOAT—THE WORLD'S LARGEST AIRPLANE. Automotive and Aviation Ind. *93*, 18–21, 92 (Aug. 15, 1945). Some of the details concerning the world's largest airplane are reported. The wing span is 320 ft., the hull 220 ft. long and the gross weight over 400,000 pounds. The plane is powered by 8 engines of 3000 h.p. each. The principal construction material is wood. Most of the wooden parts are of the laminated type and are mainly birch, although spruce, poplar, maple and balsa are used to some extent also. Three types of resin glues are used. The plywoods used on the outside surfaces and other places are bonded with a hot-curing phenol-formaldehyde resin. The heavy laminated sections are bonded with a low temperature curing urea-formaldehyde resin. Many of the joints are made with a medium curing resorcinol-formaldehyde resin.

PLASTICS FOR POSTWAR CAR AND PLANE. G. M. Kuettel. Automotive and Aviation Ind. *93*, 34–6, 88, 90, 92 (Aug. 15, 1945). The types of plastics available for use in car and plane construction are reviewed. Transparent acrylic plastics may be used for car and plane enclosures, airport lighting devices, headlight lenses, battery cases and working models. Polyvinyl butyral resins are used in laminated glass and laminated plastic windshields. Polyethylene may be used for storage battery cases and electrical insulation. Nylon may be used for hydraulic packing, shock absorbing systems, landing gears, brake lining, steering wheels, carbureter parts, valve seats, gaskets, upholstery, wall coverings and paint brush bristles.

ARTIFICIAL SPONGES OF CELLULOSE. C. A. Minors, Pulp & Paper Mag. Can. *46*, 466–7 (1945). The manufacture of cellulose sponges is discussed. Thirty references.

Materials

THE PROPERTIES AND USES OF POLYTHENES. *Part I.* E. Hunter and W. G. Oakes. British Plastics *17*, 94–8 (Mar. 1945). The electrical, thermal and mechanical properties of polyethylene are discussed. Seven grades are manufactured in England; the grades vary in intrinsic viscosity from 0.65 to 1.25, in molecular weight from 13,000 to 25,000, in softening point from 107 to 190° C., and in tensile strength from 90 to 220 kg./cm^2. The power factor varies from 0.0001 to 0.0005 according to frequency and temperature. The dielectric strength is 1000 volts per mil and the surface resistivity 10^{14} ohms. The density varies from 0.77 to 0.96 depending on the temperature from 170 to −100° C. The low-temperature flexibility of these materials is excellent. Further data are presented in tabular and graphic form. *Part II.* R. B. Richards. Ibid. *17*, 146–51 (Apr. 1945). The chemical and solubility properties of polyethylene are discussed. These polymers do not react with most chemicals at ordinary temperatures; halogens are absorbed to a slight extent without much effect on the properties. At high temperatures strong acids, oxidizing agents and the halogens have a more pronounced effect. Polyethylene is insoluble in water, esters and ketones; it is soluble in hydrocarbons and chlorinated hydrocarbons. The water vapor permeability of films 0.002 to 0.01 in. thick is about 2×10^{-9} gm./hr./cm.^{2}/cm. thickness/mm. Hg. at 20° C. Data are presented showing the viscosity of solutions of polyethylene and the absorption of several organic liquids. *Part III.* E. L. Midwinter. Ibid. *17*, 208–215, 228 (May 1945). This section is concerned principally with methods of processing and applications. Although polyethylene is very resistant to oxygen and weathering, processing in air at 160° C. has a deteriorating effect on the properties. At 120° C. the changes are not significant. For higher temperatures antioxidants are added. Detailed discussions of preheating, compounding, extruding of rods, cable covering, tubing and films, compression molding, injection molding, melt flowing, casting, powder spraying, solvent casting, welding and forming of sheets, rods and tubes are given. The molecules in films and filaments may be oriented to give improved strength characteristics. Polyethylene is readily machined. Present and proposed applications consist of cable coverings, battery boxes, packaging materials, transformer bushings, paper coatings, fabric coatings, beakers, bottles, flasks, bottle caps, gaskets and sealing rings.

PULPS FOR PULP-REINFORCED PLASTICS. S. L. Schwartz, J. C. Pew and H. R. Meyer. Paper Trade J. *121*, 42–4 (July 12, 1945). Strong, tough, resin-filled, pulp-reinforced phenolic plastics containing 40 percent resin, based on the total moisture-free weight, were made from a variety of chemical pulps. The strength properties were not dependent on fiber length or pulp-sheet strength. Thus, black maple pulps whose fibers are only a quarter of the length of spruce fibers, were found to be suitable for the production of strong plastics. Contrary to what might be expected, the plastic flow and the required molding pressure of the various chemical pulp-resin combinations were not markedly influenced by fiber length. Mechanical and semi-chemical pulps were found suitable for pulp plastics though, in general, these plastics were inferior in strength to those of the chemical pulps. In most of these plastics, however, the plastic flow of the pulp-resin combinations and the water resistance of the resultant plastics excelled those obtained with chemical pulps. Modification of the pulp by mechanical and chemical treatment prior to filling with resin, and the addition of a noncellulosic constituent, glass fiber, were used to secure pulp plastics of altered characteristics.

SILICONES. British Plastics *17*, 306–9 (July 1945). The properties and applications of the various types of silicone plastics are reviewed.

LOW - RESIN - CONTENT AND RESIN-FREE PULP PLASTICS. S. L. Schwartz, J. C. Pew and H. R. Mayer. Paper Trade J. *121*, 35–8 (Aug. 16, 1945). Experiments demonstrate that molded plastics can be made from high-yield wood pulps in which little or no phenolic resin is incorporated. A comparison of plastics so made with pulp plastics containing as much as 40 percent of phenolic resin by weight indicate some loss of ultimate tensile and compressive strength and lowered resistance to water absorption, but improved toughness. The most promising of the plastics containing no resin appeared to be those produced from pulps obtained by milling water-cooked chips. By coating the surfaces of the pulp mats with resin before molding them, their water resistance is considerably improved. Plastics of moderate strength and good water resistance are also produced by the addition of small amounts of water-soluble phenolic resin or non-phenolic resins.

Applications

LAMINANTS AND COATINGS FOR PAPERS, PLASTIC FILMS AND METAL FOILS. F. B. Speyer. Paper Trade J. *121*, 33–6 (July 5, 1945). The application of laminating and coating compositions to papers, plastic films, cloths, metal foils and nonflexible materials is discussed. The methods which

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have been shown most satisfactory for using specific formulations with various packaging materials are considered. A concise study of surface coatings, hot melts and laminating adhesives is presented. Correlations are drawn between the properties of various formulations and the properties of some base surfaces. Papers give the best base surfaces for adhesion to all types of compositions, which is probably because of their fiber structure. The most difficult films to find adhesives for are the waxy types such as polythene. Addition of wax to formulations decreases their adhesive properties. Hot melts all show some degree of heat sealability and consequently are susceptible to blocking. Water vapor impermeability may be attained by using waxy type adhesives and coatings, by laminating metal foils to the water sensitive surface or by using a wax-laminant in conjunction with such films as vinylidene chloride or polyethylene plastics. Flexibility with a minimum of plasticizer is most prevalent in rubber type formulations. Grease- and oil-proofness may be increased by using water- and alcohol-soluble composites in conjunction with such films as vinyl copolymers, methyl cellulose, polyvinyl alcohol and polyamides.

ENGINE BAGS OF NEW VINYL-FOIL MATERIAL. Modern Packaging *18*, 96–100, 164 (Aug. 1945). Two laminated packaging materials are described. One consists of one layer of each of the following in the order indicated: 0.002-in. vinyl plastic film, 0.001-in. aluminum foil, 0.0015-in. vinyl plastic film and fabric. The other consists of 0.0014-in. vinyl plastic film, a layer of adhesive, 0.001-in. aluminum foil, a layer of adhesive, 0.0014-in. vinyl plastic film, a layer of adhesive and fabric. Test methods and properties are described.

VINYL RESIN ADHESIVES USE IN WEATHERPROOF BOXES. D. Santmyers. Paper Trade J. *121*, 44–5 (July 26, 1945). Waterproof vinyl resin base adhesives which were developed to meet a specific need of the solid fiber industry are described. Their use as weatherproof adhesives is possible because of the unique property of being water-soluble in the adhesive solution preparation stage but developing remarkable water resistance under the conditions of use. A weatherproof adhesive solution can easily be prepared from the dry powdered adhesives by first slurrying in water, then cooking, and finally cooling to 100 to 130° F. The dry powders and the prepared adhesive solutions remain stable indefinitely unless contaminated by materials that will spoil in themselves. The advantages of the vinyl resin base adhesive are: high rate of board production with low waste; simplicity of adhesive preparation; adhesive solution stability; the production of high quality, firm, dry, odorless board with dependable water resistance and noncorrosive glue line.

EFFECT OF HEAT ON PORTLAND CEMENTS CONTAINING VINSOL RESIN. L. Bean and A. Litvin. A.S.T.M. Bull. No. *135*, 31–2 (Aug. 1945). Vinsol resin when heated in a beaker at 300° F. definitely carbonizes. In 51 hours about one-fourth of a 1-gram sample is lost by volatilization or oxidation. When cement containing interground Vinsol resin is heated at temperatures as high as 300° F. for periods as long as 48 hr., in a rotary mill, as much as two-thirds of the resin is lost as measured by the chloroform-soluble method. The methoxyl content of the residual resin is considerably reduced, and cement so treated has considerably less air-entraining properties than the same cement before heating. Dichlorethylene extracts more resin than chloroform from Vinsol resin cements which have been subjected to considerable heat treatment.

VACUUM PACK WITH FLEXIBLE CELLULOSE MATERIAL. A. H. Woodcock. Modern Packaging *18*, 144–5, 174 (Aug. 1945). Films of wax-coated laminated cellophane were shown to transmit carbon dioxide 25 times as rapidly as they transmit oxygen. Packages made from this film and gas-packed with carbon dioxide produce a vacuum pack on standing. Factory trials indicated that this type of packaging is feasible commercially and shipping trials have shown it to be reasonably substantial. Storage trials at 26.7 and 37.8° C. showed the package to be effective for a period of six months. Ten references.

Coatings

SAFE SPRAYING PRACTICES. Organic Finishing *6*, 25–32 (Jan. 1945); 24–28, 47 (Feb. 1945); 23–7 (Mar. 1945). Discussion of spraying precautions, ventilation and exhaust respirators and masks, fire protection, housekeeping and other topics which will be of use and interest to all who are responsible for or interested in safety in spraying operations.

FIRE FIGHTING FOR FINISHERS. Organic Finishing *6*, 29–32 (Feb. 1945). For the many new people engaged in finishing there is need for information on fire fighting equipment and methods. The discussion prepared by the Safety Research Institute describes the what and how of fighting fires in and around finishing departments.

PERMEATION AND SORPTION OF WATER VAPOR IN VARNISH FILMS. A. M. Thomas and W. L. Gent. Proc. Phys. Soc. *57*, 324–40 (July 1945). An experimental investigation on the moisture permeability and sorption of detached varnish and polystyrene films is described. A detailed picture of the mechanism of permeability cannot be presented yet. Nevertheless some observations on the effect of structure are possible: (1) The greater the occurrence of water-attractive groups the higher the permeability of the substances. (2) The greater the degree of order in the structure, that is, the greater the regular molecular orientation, the less is the permeability. These two factors acting together determine the permeability of any organic insulating material of the types considered. In varnishes the effects are about balanced; more permeable substances, such as cellulose derivatives, have much greater sorptive powers; the less permeable materials, such as highly vulcanized rubbers, and waxes, have more ordered structure. The importance of the structure of the material has been recognized in the manufacture of oriented polystyrene, which has only half the moisture permeability of the randomly oriented material. Further, the two factors are clearly important for the dielectric and mechanical behavior of insulating materials. Thus it seems possible that relationships between these properties and the moisture permeability may be developed in terms of the physical and chemical properties of the molecules.

RESINS AND LACQUERS BASED ON SUBSTITUTED PHENOLS FROM PEAT TAR. A. Y. Drinberg and P. P. Krechko. J. Applied Chem. (U. S. S. R.) *17*, 458–62 (1944); Chem. Abstracts *39*, 3690–1 (Aug. 20, 1945). Alkylated phenols obtained by the alkylation of peat tar phenols with isobutylene were condensed with formaldehyde to produce resins suitable for use in lacquer formulation.

A NEW COATING THICKNESS GAGE. S. Lipson. A.S.T.M. Bull. No. *135*, 20–3 (Aug. 1945). A new coating thickness gage is described which employs the electro-magnetic principle for determining the thickness of nonmagnetic coatings on steel. The principle of the operation is as follows: As a soft iron core is withdrawn from the field of an energized alternating current solenoid, the magnetic pull upon the core increases. If the solenoid is held in a vertical position over a coated steel article and lowered sufficiently to permit the lower end of the core to contact the surface, the distance through which it must be raised for the pull of the solenoid to overcome the attraction of the core for the ferro-magnetic basis metal will vary inversely with the thickness of the coating. The reproducibility of the instrument was found to range from ±5 percent for films up to 0.002 in. to ±3 percent for coatings exceeding 0.002 inch. Voltage variations occurring within reasonable limits had no significant effect on the accuracy of the determinations. The experimental instrument, which was developed to measure coating thickness up to 0.008 in., is also characterized by the following properties: simplicity, small size, low cost and rapid measurement.

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TECHNICAL BRIEFS

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Engineering

NEW PROCESS FOR BONDING THERMOSETTING PLASTICS. Plastics (London) *9*, 420–2 (Sept. 1945). Strong bonds between thermosetting plastics are obtained by a new technique. The method consists of abrading the surfaces to be bonded in the presence of a solution of a special phenolic resin before applying the appropriate cold-setting cement. Joints made in this manner are stronger than the bonded materials themselves. The process is particularly applicable to laminated plastics and resin-impregnated woods.

APPLICATION OF STATISTICAL METHODS TO THE PRODUCTION OF SYNTHETIC RUBBER. G. R. Vila and M. D. Gross. Rubber Age *57*, 551–8 (Aug. 1945). The application of statistical methods to the production of GR-S are described. The following conclusions are drawn: (1) The statistical concepts of frequency distribution, standard deviation, control charts, variance analysis, and simple and multiple correlation are powerful tools for the extraction of useful information from large masses of plant operating data. (2) Statistical methods may be applied in a "dynamic" sense for control of current operations or in an analytical or "historical" sense for the longer range development of more desirable operating procedures. (3) The use of statistical methods in the dynamic sense will not improve the process *per se* nor will it automatically correct operational deficiencies. Properly applied, however, it will indicate promptly and accurately when correctional measures are necessary.

FIRE CONTROL IN THE MANUFACTURE OF SYNTHETIC ADHESIVES AND COATING COMPOUNDS. P. W. Eberhardt. Rubber Age *57*, 573–4 (Aug. 1945). The fire control equipment in a plant manufacturing organic adhesives and coatings is described.

Chemistry

POLYMERIZATION OF NITROOLEFINS. THE PREPARATION OF 2-NITROPROPENE POLYMER AND OF DERIVED VINYLAMINE POLYMERS. A. T. Blomquist, W. J. Tapp and J. R. Johnson. J. Am. Chem. Soc. *67*, 1519–24 (Sept. 1945). 2-nitropropene undergoes a smooth and rapid polymerization in the presence of aqueous potassium bicarbonate solution. Catalytic hydrogenation of 2-nitropropene polymer in dioxane with Raney nickel under mild conditions affords a water-soluble polymer which appears to be a linear polymer with primary amine groups, composed of 24–28 recurring 2-aminopropene units. Hydrogenation of the nitroölefin polymer under more drastic conditions is accompanied by extensive deamination and yields a lower molecular weight dioxane-soluble polyamine and dioxane insoluble product.

PHENOMENOLOGICAL THEORY OF EMULSION POLYMERIZATION. E. W. Montroll. J. Chem. Phys. *13*, 337–48 (Aug. 1945). The process of emulsion polymerization is observed to occur in the following manner. An aqueous emulsion of monomer is prepared using a soap as the emulsifier. The addition of a catalyst starts the polymerization after an initiation period whose length depends on the mean radius of the monomer globules (long periods for large mean radius and short periods for small mean radius). As the reaction proceeds, the mean radius of the globules diminishes and the free soap concentration increases. It is believed that the initiation period is the result of the existence of an inhibitor in the monomer. The catalyst reacts with that part of the inhibitor which is dissolved in the water phase, so that in order for equilibrium to be restored some of the inhibitor must diffuse out of the monomer. Rate curves are derived on this basis using the added assumptions: (a) polymerization occurs at the monomer-water interface after the inhibitor concentration has reached a low threshold value, (b) radius distribution function of monomer has a single maximum.

OXIDATION AND POLYMERIZATION OF STYRENE. S. Medvedev and P. Tseitlin. J. Phys. Chem. (U. S. S. R.) *18*, 13–32 (1944); Chem. Abstracts *39*, 3197–8 (Aug. 10, 1945). The oxidation and polymerization of styrene between 70 and 90° C. and in the presence of various materials were investigated. The oxidation of styrene consists of two chain reactions. The second chain is started by the decomposition of a hydroxy peroxide which is formed from the unstable peroxides of benzene and styrene. Both chain reactions are propagated by free radicals. The ratio of the oxidation process to the polymerization process is constant over the temperature range studied. The addition of various amounts of benzene or benzoyl peroxide and the presence of various surfaces has no effect on this ratio. The difference in the energies of activation for polymerization and oxidation is 4.87 kg-cal. This indicates that the initiation and mechanism for both the oxidation and polymerization of styrene take place by means of the same intermediates, namely, free radicals.

THE HARDENING PROCESS OF PHENOL-FORMALDEHYDE RESINS. X. A. Zinke, E. Zeigler, E. Martinowitz, H. Pichelmayer, M. Tomio, H. Wittmann-Zinke and S. Zwanziger. Ber. *77B*, 264–72 (1944); Chem. Abstracts *39*, 3524–5 (Aug. 20, 1945). The mechanism of the curing of phenol-formaldehyde resins was investigated. The process involves the formation of polyether chains, followed by partial thermal cleavage and finally disappearance of the ether bridges. The ether bridges are converted into methylene bridges with the loss of formaldehyde and the formation of methides with their subsequent reactions. Alkalis promote the formation of methylene bridges.

CHROMATOGRAPHIC ADSORPTION OF AMINO ACIDS ON ORGANIC EXCHANGE-RESINS. C. S. Cleaver, R. A. Hardy, Jr., and H. G. Cassidy. J. Am. Chem. Soc. *67*, 1343–52 (Aug. 1945). The responses toward several amino acids of a cation-exchange and an acid-binding synthetic organic resin were examined. The influence of the following factors upon the responses were investigated: type of resin, particle size, length of adsorption column, rate of flow, concentration of amino acid in solution, hydrogen ion concentration of the solution. The investigation was extended to several binary and two ternary mixtures of amino acids, and evidence regarding their separability was obtained. An attempt is made to explain the effects observed. The problems involved in separating amino acids on exchange-resins are considered as well as the factors needing further investigation.

Properties

DIMENSIONAL STABILITY OF CELLULOSE THERMOPLASTICS. W. E. Gloor. Product Engineering *16*, 554–7 (Aug. 1945). The dimensional stability of 3 formulations of high-acetyl cellulose acetate, 2 of cellulose acetate butyrate and 3 of ethyl cellulose were determined after exposure to various temperature and relative humidity conditions and to cyclic conditions involving extremes of temperature and relative humidity. The tests were made with injection-molded tensile bars, disks and strips and extruded strips. The dimensional stability of sheet ma-

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terials was also investigated. In general, the heavier sections are the most dimensionally stable. The hard-flow high-acetyl cellulose acetates, the hard-flow cellulose acetate butyrates and the softer-flow ethyl cellulose compositions are about equal in retention of shape. The hard-flow ethyl cellulose samples are the best in this respect. Factors found helpful in developing the maximum dimensional stability in molded pieces of high-acetyl cellulose acetate plastics were: wide-gated molds, complete filling of mold at uniform and rapid rates, travel of plastic in one direction with a minimum spread during the filling of the mold, total molding cycle of less than 23 seconds, and use of warm molds. Ethyl cellulose was least sensitive to these factors and cellulose acetate butyrate fell in between ethyl cellulose and cellulose acetate. Injection molding of ethyl cellulose with a flow as low as S3 yielded moldings of a stability equal to that of the cellulose esters of H2 or harder flow. Extruded and skive-sheeted samples showed somewhat better resistance to dimensional change than did injection molded samples. Ethyl cellulose and cellulose nitrate sheet stock were particularly resistant in this respect.

PHYSICAL PROPERTIES OF CELLULOSIC PLASTICS. Product Engineering *16*, 503–4 (July 1945). Graphs showing the variation of tensile strength, tensile elongation, flexural strength, compressive strength, deformation under load, Brinell hardness, Rockwell hardness, impact strength and water absorption with the flow temperature of the usual cellulose acetate and the high-acetyl cellulose acetate formulations are presented.

THEORY OF THE DIELECTRIC PROPERTIES OF DIPOLAR SOLIDS. H. Frohlich. Rep. Brit. Elect. Allied Industr. Res. Assoc., Ref. L/T 124, 15 pp. (1941). A mathematical concept for the theory of permittivity of organic dipolar solids is developed.

THEORY OF THE DIELECTRIC PROPERTIES OF DIPOLAR SOLIDS: CALCULATION OF DIELECTRIC LOSSES. H. Frohlich. Rep. Brit. Elect. Allied Ind. Res. Assoc., Ref. L/T 132, 8 pp. (1942). The theory of dielectric properties is extended to the case where the external field varies with time.

ELASTIC PROPERTIES OF PLASTIC MATERIALS. J. Delmonte. Trans. A. S. M. E. *67*, 477–81 (Aug. 1945). Unlike most metals, the average plastic material does not have a sharp break in the stress-strain curve to denote the yield strength or elastic limit. Usually experience or even conjecture is the guide to determining working stresses. Beam deflection methods of obtaining elastic-limit stress data are discussed. These have special significance in practical applications. A curve deviation method is also suggested by means of which elastic limits are more accurately determined than by conventional stress-strain technique. Comprehensive data on short-time creep of organic plastics are presented.

WATER-VAPOR PERMEABILITY. W. H. Aiken, P. M. Doty and H. Mark. Modern Packaging *18*, 137–40, 166, 168 (Aug. 1945). The factors affecting water-vapor transmission through thin films are discussed. The transmission values depend on both the chemical and mechanical structure. The effects of temperature and humidity on the transmission are explained. Data for various plastic films are reported. Three references are given in this article.

Testing

MACHINE MEASURES KNITTING FACTOR OF SYNTHETIC YARNS. L. E. Rossiter and E. A. Robinson. Textile World *95*, 100–1 (Mar. 1945). A machine for measuring the knitting factor of synthetic yarns is described. Wax treatments normally cause greater drag than oil.

USE OF LOW-ANGLE X-RAY SCATTERING IN THE STUDY OF CATALYSTS, VIRUSES, AND OTHER MATERIALS. F. G. Firth. Rubber Age *57*, 561–4 (Aug. 1945). The use of low-angle X-ray scattering in determining the dimensions of small particles and crystalline areas is described. Materials such as viruses, asbestos fibers, stretched rubber, polyamide fiber and oriented rayon are considered in the discussion.

ADHESION—A REVIEW. F. M. Damitz. Paint Ind. Mag. *60*, 154, 156, 158, 160, 162, 164 (1945). Test methods for measuring the adhesion of coatings to a base material are reviewed.

SIMPLIFIED WVP TEST FOR PAPERS AND FILMS. A. W. Schwab, L. B. Falkenburg and J. C. Cowan. Modern Packaging *18*, 141–3 (Aug. 1945). A modified method for determining the water-vapor permeability of coated papers or films at 100° F. and 95 percent relative humidity is described. This method gives reproducible results and is readily adaptable to different experimental conditions. Fifteen references.

A COMPARISON OF THE EFFECT OF REFERENCE FUELS SR-6 AND SR-10 WITH FUEL 813J AND 62-OCTANE GASOLINE ON SYNTHETIC RUBBER COMPOUNDS. A.S.T.M. Bull. No. *135*, 33–4 (Aug. 1945). The effects of reference fuel SR-6 (60 percent di-isobutylene, 5 percent benzene, 20 percent toluene and 10 percent xylene), 813J (similar to SR-6 except 60 percent 62-octane gasoline in place of the di-isobutylene), SR-10 (di-isobutylene) and 62-octane gasoline on synthetic rubber compounds were investigated. The volume increase, tensile strength and elongation were measured. Reference fuel SR-6 gave results which for all practical purposes were identical with those obtained from fuel 813J. Reference fuel SR-10 gave an appreciably lower swell and a correspondingly lower drop in tensile strength than 62-octane gasoline. The reproducibility between laboratories for both the volume change tests and tensile strength and elongation change tests was excellent for both reference fuels, but not significantly better for the reference fuels than for fuel 813J or 62-octane gasoline. It is recommended that reference fuels SR-6 and SR-10 be used as immersion media for specification purposes in place of the fuels now used with the proviso that adjustments in specification limits for reference fuel SR-10 be made in those cases where it appears to be necessary.

Synthetic rubber

ELASTIC BITUMENS. D. C. Broome. J. Soc. Chem. Ind. *64*, 149–51 (May 1945). Schemes for increasing the elasticity of bitumens by oxidation are discussed. Mixtures of bitumen with powdered rubber and with rubber latex are discussed and some details are included concerning the preparation and properties of modern forms of sulfurized bitumens. The use of elastic bitumens in partial replacement of natural rubber, reclaimed rubber and synthetic rubber of the GR-S type is discussed with particular reference given to their mechanical and electrical properties.

A NEW METHOD FOR DETERMINING THE FREEZE RESISTANCE OF VULCANIZATES. J. A. Talalay. Rubber Age *57*, 433–6 (July 1945). A modified ring modulus hardness tester was used to determine the freeze resistance of natural, GR-S, butyl and neoprene compounds. The apparatus and the test procedure are described in detail. Between 82 and 0° F., the four compounds behaved similarly. The neoprene began to freeze at −50° F., the natural rubber at −40° F., the GR-S at −30° F. and the butyl at −30° F. The Shore and Pusey-Jones hardnesses were also determined for 11 compounds and correlation curves for relating these values to the ring modulus hardness are given.

LEATHER RESINOID. A. Colin-Russ. India-Rubber J. *107*, 325, 327-31 (1944). The physical characteristics of butadiene-styrene copolymer, with and without rubber reclaim or Thiokol, extended with leather resinoid are reported.

PROPERTIES OF SYNTHETIC RUBBERS. I. OIL-RESISTING RUBBERS OF THE BUNA-N TYPE. R. G. Newton. J. Rubber Research *14*, 63–80 (1945). The properties of the butadiene-acrylonitrile rubbers are reviewed. Twenty-eight references.

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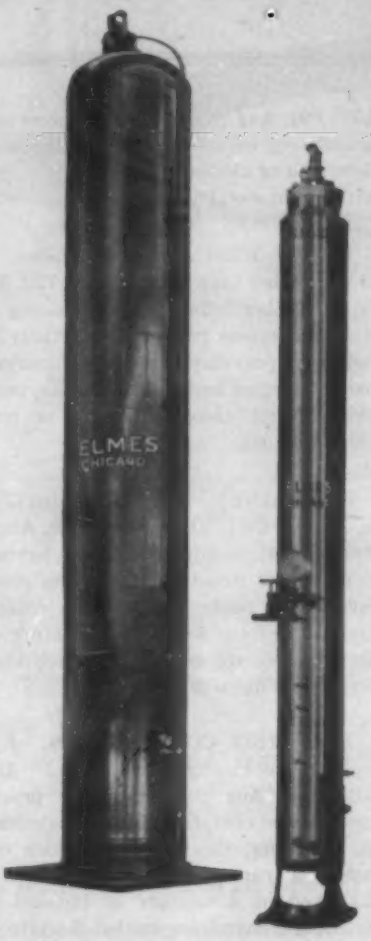

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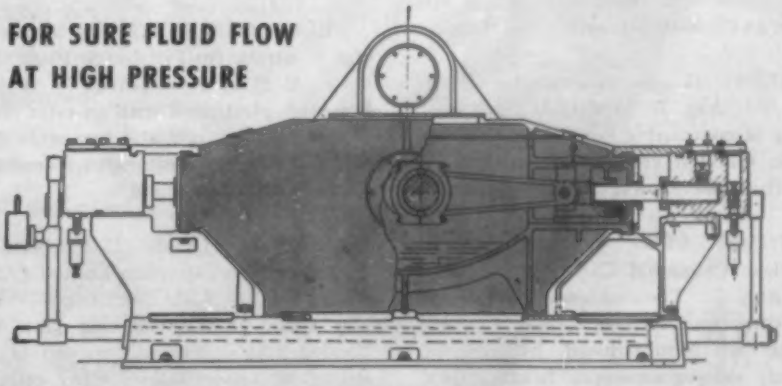

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U. S. Plastics Patents

Copies of these patents are available from the U.S. Patent Office, Washington, D. C., at 10 cents each.

INJECTION PRESS. W. R. Tucker (to Hydraulic Development Corp., Inc.). U. S. 2,380,882, July 31. An injection molding machine for plastic materials.

CELLULOSE ESTERS. F. J. Kaszuba (to General Aniline and Film Corp.). U. S. 2,380,896, July 31. Cellulose acyl polycarboxylates are prepared by esterifying a partially acylated cellulose with a polycarboxylic acid anhydride or chloride in the presence of 1.4-dioxane.

POLYVINYL ACETAL. L. E. Cheyney (to Wingfoot Corp.). U. S. 2,380,925, Aug. 7. A polyvinyl acetal composition plasticized with an amide formed by reacting equal molar proportions of a polyalkylene polyamine and a monocarboxylic fatty acid.

POLYVINYL ACETAL. L. E. Cheyney (to Wingfoot Corp.). U. S. 2,380,926, Aug. 7. A polyvinyl acetal composition plasticized with oleyl alcohol or phytol.

VINYL TEXTILES. B. G. Wilkes and W. A. Denison (to Carbide and Carbon Chemicals Corp.). U. S. 2,381,020, Aug. 7. The tendency to accumulate a static charge on vinyl filaments is offset by applying a composition comprising a wetting agent and a water-dispersible polyethyleneimine, and subsequently applying an aliphatic aldehyde.

SHEET. H. E. Kallmann. U. S. 2,381,061, Aug. 7. A flexible sheet consisting of contrasting flexible filaments of plastic material compressed into homogeneity and having a textile pattern.

CONDENSATES. W. P. Bricks (to American Cyanamid Co.). U. S. 2,381,121, Aug. 7. The condensation product of a compound such as formoguanamine having an N-substituted hydrocarbon radical, valeroguanamine, hexanoguanamine, lauroguanamine, stearoguanamine.

DENTAL FLOSS. A. A. Stonehill (to Johnson and Johnson). U. S. 2,381,142, Aug. 7. A dental floss is prepared by forming a thread of a number of synthetic fibers of unplasticized vinyl resin and partially fusing by passing through a wax bath at from 65° to 100° C.

MOLDING POWDER. R. A. Caughey (to Univ. of New Hampshire). U. S. 2,381,205, Aug. 7. A moldable lignocellulose composition obtained by treating wood chips with a non-oxidizing dilute acid, drying and powdering.

PLASTICIZER. R. H. Barth and H. Burrell (to Heyden Chemical Corp.). U. S. 2,381,247, Aug. 7. A plasticized film-forming composition such as a cellulose ester or ether, the plasticizer being pentraerythritol diacetate dipropionate or dipentaerythritol triacetate tripropionate.

VINYL RESINS. W. R. Cornthwaite and N. D. Scott (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,381,338, Aug. 7. A copolymer of trichlorethylene and vinyl trimethylacetate.

SHOE. M. P. Riesing (to Firestone Tire and Rubber Co.). U. S. 2,381,389, Aug. 7. A shoe containing a molded foot-supporting structure having a reversely curved foot-conforming top face and a flat ground-engaging bottom face.

COATING. F. W. Hall (to Pittsburgh Plate Glass Co.). U. S. 2,381,495, Aug. 7. The abrasion resistance of a body of plastic material is improved by coating with a thin film of plastic material, which is adherent to the body and which is hardenable to the infusible abrasion resistant state, and curing the coating.

CELLULOSE ESTER. I. E. Muskat and F. Strain (to Pittsburgh Plate Glass Co.). U. S. 2,381,511, Aug. 7. A cellulose ester plasticized with an ester of one mol of a polyglycol and two mols of an acid half-ester of a saturated monohydric alcohol and carbonic acid.

WINDOW SHADE. C. S. Hyatt and T. J. Kerr (to Columbus Coated Fabrics Corp.). U. S. 2,381,542, Aug. 7. Window shade cloth comprising glass fiber bonded with a coating composition consisting of nitrocellulose, ethyl cellulose, cellulose acetate or cellulose acetate butyrate, pigment and plasticizer.

VINYL COMPOUNDS. H. P. Staudinger, K. H. W. Tuerck and C. E. Brighton (to Distillers Co., Ltd.). U. S. 2,381,561, Aug. 7. Vinyl polymers are prepared by polymerizing in the liquid phase in the presence of the peroxide of an aldehyde containing a double bond.

WRAPPING SHEET. P. H. Scrutchfield (to Hercules Powder Co.). U. S. 2,381,694, Aug. 7. Wrapping sheets comprising regenerated cellulose carrying a clear film of chlorinated rubber stabilized with a light metal naphthenate.

VINYL RESIN. C. F. Brown (to U. S. Rubber Co.). U. S. 2,381,720, Aug. 7. A rubber substitute comprising the heat conversion product of partially hydrolyzed polyvinyl ester, an inorganic oxidizing agent and picryl chloride, pentachlorophenol, chloroacetanilide or tetrachloroquinone.

CONTAINER. R. B. Gray (to Glenn L. Martin Co.). U. S. 2,381,739, Aug. 7. A hydrocarbon liquid container having a flexible wall structure comprising several layers of rubberlike plastic material bonded to form a unitary structure and an intermediate membrane consisting of a synthetic linear polyamide.

PRINTING COMPOSITION. J. R. Abrams (to Interchemical Corp.). U. S. 2,381,868, Aug. 14. A textile printing composition comprising pigment dispersed in a lacquer, the binder of which comprises a carbamide-formaldehyde resin dissolved in a mixture of butanol and xylene and containing methyl abietate.

PRINTING COMPOSITION. N. S. Cassel (to Interchemical Corp.). U. S. 2,381,878, Aug. 14. A textile printing paste comprising a pigment, a water-insoluble cellulose ether dissolved in carbon tetrachloride and a solvent-soluble urea-formaldehyde resin.

COATINGS. H. S. Rothrock (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,381,884, Aug. 14. A beta-furylacrylic acid modified alkyd resin and coatings containing it.

COATING TREATMENT. A. M. Wickwire, Jr. (to Interchemical Corp.). U. S. 2,381,942, Aug. 14. A thermoplastic coating which has been applied on one surface of a traveling web is smoothed by applying a high temperature flame upon the coated surface, smoothing the surface and applying a second flame upon the coated surface.

WOOD FINISHING. M. M. Wilson and W. E. Berry (to Interchemical Corp.). U. S. 2,381,944, Aug. 14. Wood is finished by applying a resinous coating which is polymerizable at 150 to 250° F. and heat-

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ing at such temperature until it is cured in the presence of a high concentration of water vapor.

ESTER RESINS. W. R. Catlow, Jr. (to Bakelite Corp.). U. S. 2,381,969, Aug. 14. A resinous product comprising the coester reaction product of an acidic natural resin, a cyclopentadiene adduct to maleic anhydride, a polyhydric alcohol.

ETHYL CELLULOSE. H. Dreyfus. U. S. 2,381,972, Aug. 14. Cellulose ethers are prepared by etherifying cellulose with diethyl sulfate in the presence of sodium hydroxide and at least 40 percent of tetraethyl ethylenediamine.

COMPOSITE STRIPS. G. H. Schanz (to B. F. Goodrich Co.). U. S. 2,382,177, Aug. 14. An apparatus for uniting a plurality of plastic materials in strip form.

RESIN. K. M. Thompson (to Atlantic Refining Co.). U. S. 2,382,184, Aug. 14. A resin is prepared by reacting a petroleum oil fraction containing cyclic hydrocarbons with an aldehyde in the presence of a condensing agent consisting of boron-fluorine compounds.

CONDENSATES. H. Ulrich (to General Aniline and Film Corp.). U. S. 2,382,185, Aug. 14. Nitrogenous condensates are obtained by condensing a monomeric or polymeric 1,2-alkyleneimine with a chlorocarbonic acid ester of a higher aliphatic alcohol.

RESIN. G. F. D'Alelio and J. W. Underwood (to General Electric Co.). U. S. 2,382,211, Aug. 14. The reaction product of an aldehyde, a diazine derivative.

LINOLEUM COMPOSITIONS. L. H. Dunlap (to Armstrong Cork Co.). U. S. 2,382,212, Aug. 14. A linoleum composition comprising filler particles, a binder including a copolymer of drying oil free of conjugated double bonds which has been oxidized and a vinyl compound such as styrene or acrylonitrile and an acid polymerization catalyst.

COPOLYMER. L. H. Dunlap (to Armstrong Cork Co.). U. S. 2,382,213, Aug. 14. A toluene-insoluble copolymer of a drying oil free of conjugated double bonds which has been oxidized and a vinyl compound of some kind such as acrylonitrile or styrene.

PLASTICS. W. Laufenberg, E. Maslanka and H. Weissenburger (to Licoro Corp.). U. S. 2,382,238, Aug. 14. Synthetic plastics and films which are organic solvent insoluble are prepared by condensing an aliphatic polyamine having a primary amine group with an aldehyde and a phenol to a point where the composition is still soluble in organic solvents, mixing with a nitrocellulose varnish and promptly applied as a varnish.

INSULATION. O. A. J. van Lin and J. Hoekstra (to Alien Property Custodian). U. S. 2,382,275, Aug. 14. An insulated electric cable comprising a conductor combined with an insulating layer of rubber hydrochloride.

FLOOR COVERING. M. E. Cupery (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,382,297, Aug. 14. A floor covering comprising an asphalt-impregnated paper and a coating containing a gelled polyhydric alcohol mixed ester of a poly-unsaturated monocarboxylic acid having alpha-,beta-ethylenic unsaturation conjugated with at least one other ethylenic double bond, a natural drying oil and a pigmented filler.

CHLORINATED RUBBER. H. L. Tomkinson (to Hercules Powder Co.). U. S. 2,382,353, Aug. 14. Chlorinated rubber of improved compatibility with alkyd resins is prepared by dissolving rubber in a solvent inert to chlorine, chlorinating until evolution of great heat decreases, passing free oxygen into the solution concurrently with chlorine until the desired viscosity is reached, and finally continuing chlorination without oxygen until the desired chlorine content has been reached.

LUMINOUS ROPE. R. F. Warren, Jr. U. S. 2,382,355, Aug. 14. A rope coated with a phosphorescent material to which is then added a coating of plastic material.

CELLULOSE ESTERS. R. B. Darling (to Hercules Powder Co.). U. S. 2,382,399, Aug. 14. Cellulose is prepared for esterification with lower fatty acids by adding a magnesium compound to a processing water containing dissolved calcium and treating purified cellulose to incorporate therein a predetermined quantity of magnesium.

THERMOPLASTIC. D. J. Beaver (to Monsanto Chemical Co.). U. S. 2,382,462, Aug. 14. A new plastic is prepared by mixing scrap rubber with tolyl dichlorophosphine.

THERMOPLASTIC. G. D. Martin (to Monsanto Chemical Co.). U. S. 2,382,497, Aug. 14. A new plastic is prepared by mixing a rubber with an organic phosphine halide.

INSULATION. J. F. Morley (to International Standard Electric Co.). U. S. 2,382498, Aug. 14. A homogeneous material suitable for insulation purposes comprising a polymerized mono-olefin and a polymerized mono-nuclear aromatic vinyl hydrocarbon compound is prepared by swelling rubber in liquid styrene to form a millable compound, heating to polymerize the styrene and finally milling some polymerized mono-olefin into the composition.

CHLORINATED RUBBER. L. Auer. U. S. 2,382,529, Aug. 14. In the preparation of chlorinated rubber coatings the chlorinated rubber is compounded with a fatty oil prepared by dispersing in an oil a salt of an alkali metal, ammonium, alkaline earth metal, zinc or magnesium in order to heat body the oil, and treating with a dissolution-promoting agent such as a phenol, a naphthol, benzoic acid or phthalic acid.

CELLULOSE ACETATE. O. Huppert. U. S. 2,382,636, Aug. 14. A stable aqueous emulsion of cellulose acetate consisting of a solution of cellulose acetate in isophorone, an aqueous solution of gelatin, maleic anhydride, sulfonated castor oil.

RESIN. W. O. Kenyon and T. F. Murray, Jr. (to Eastman Kodak Co.). U. S. 2,382,640, Aug. 14. A resinous homopolymer of a 2-aryl-4-methylene-1,3-dioxolane.

MOLDING MACHINE. W. O. Nichols (to Allied Plastics Co.). U. S. 2,382,655, Aug. 14. A plastic molding machine including an auxiliary hopper and a device for chopping and feeding scrap material into the hopper.

RUBBERLIKE POLYMERS. H. W. Walker (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,382,684, Aug. 14. A plastic rubberlike material prepared by polymerizing in aqueous dispersion in the presence of diazonium salts a polymerizable acyclic 1,3-diene hydrocarbon and its monohalogen derivatives.

SWELLING AGENT. W. Hentrich, W. Kaiser and R. Endres (to Alien Property Custodian). U. S. 2,382,714, Aug. 14. A plastic composition comprising a plastic base such as a cellulose ether, cellulose ester and resins and a plasticizer comprising a compound which has a heterocyclic nucleus having as part of its ring a thio imino group.

POLYGLYCEROL RESIN. H. H. Young, C. S. Young and P. Bradford (to Industrial Patents Co.). U. S. 2,382,764, Aug. 14. A polyglycerol resin is prepared by injecting steam into the molten residue of a glycerol still following a glycerol purification distillation to cool and dissolve the residue, precipitating impurities from the aqueous solution by adding water soluble salts, separating, concentrating by evaporation, selectively dissolving the polyglycerol resin from the salts and recovering the resin from the solvent.

MOLDED ARTICLE. J. F. Motson. U. S. 2,382,806, Aug. 14. A method for making indicia bearing plates which consists in coating a fluorescent material carrying portion of synthetic plastic material with a light sensitive material, disposing a translucent indicia carrying

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sheet over the coated surface and exposing the exterior to a light source, removing the unexposed portion with an alcohol and depositing nigrosine in alcohol solution on the exposed sections, and finally applying a protective coating.

RESINS. K. H. Weber (to Armstrong Cork Co.). U. S. 2,382,838, Aug. 14. Fossil resins are heated with a polyethylene-amine containing at least two ethylene groups which are long enough to cause amide formation.

POLYMERS. W. F. Gresham (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,382,938, Aug. 14. A polymeric linear monovicinal glycol formal.

SAFETY GLASS. J. H Boicey and I. A. Willey (to Libbey-Owens-Ford Glass Co.). U. S. 2,382,956, Aug. 21. Safety glass is prepared by assembling two layers of glass and an interposed layer of plastic material to form a sandwich in which the plastic layer projects beyond the glass layers, applying paperboard strips to the plastic border, bonding the plastic and glass, removing paperboard strips.

SHEET MATERIAL. H. Dreyfus (to Celanese Corp. of America). U. S. 2,383,047, Aug. 21. Sheet material is produced by flowing a sheet of dope continuously on a series of casting plates, causing the dope to set and stripping sheet from plates.

LUMINESCENT ARTICLES. M. L. Macht and M. M. Renfrew (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,383,067, Aug. 21. Luminescent cast articles are prepared by suspending a luminescent pigment and finely dispersed polymethyl methacrylate in a polymerizable vehicle such as an ester of acrylic or methacrylic acids.

TERPENE RESINS. A. L. Rummelsberg (to Hercules Powder Co.). U. S. 2,383,084, Aug. 21. A resin prepared by copolymerizing an acyclic terpene and an aromatic compound having a nuclearly substituted unsaturated aliphatic substituent at a temperature between −60° and 200° in the presence of a polymerization catalyst.

COLLAPSIBLE TUBES. C. E. Voke. U. S. 2,383,230, Aug. 21. Collapsible tubes are prepared by forming a tubular body of a thermoplastic material attached by means of solvent wetting to an end piece of another plastic material followed by fusion with heat.

PHENOLIC RESINS. R. W. Auxier and W. C. Weltman (to Westinghouse Electric Corp.). U. S. 2,383,283, Aug. 21. A stabilized resinous composition comprising a potentially thermosetting phenolaldehyde and an oil such as tung or oiticica and a pyridine homolog, lecithin or dicyandiamide.

ROSIN CONDENSATE. E. A. Bried (to Hercules Powder Co.). U. S. 2,383,289, Aug. 21. The condensate of a natural rosin with an aldehyde in the presence of an organic acid having a low dissociation constant, and the reaction product of the condensate with an aliphatic acid of from 6 to 18 carbon atoms.

PROPELLER. W. R. Riley. U. S. 2,383,342, Aug. 21. An airplane propeller blade comprising a hollow metallic body portion and a supplementary body of a plastic material bonded thereto.

CELLULOSE ETHERS. S. L. Bass, L. A. Rauner and P. H. Lipke, Jr. (to Dow Chemical Co.). U. S. 2,383,361, Aug. 21. Cellulose ethers are insolubilized and stabilized against heat by dispersing in a solution of the ether a modified diphenylamine.

RESIN. W. E. Lundquist (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,383,399, Aug. 21. Polymeric carboxylic anhydrides are prepared by reacting maleic anhydride, a terpene having not more than two double bonds, and a polymerizable mono-olefin such as styrene or indene.

RESINS. W. C. Weltman (to Westinghouse Electric Corp.). U. S. 2,383,430, Aug. 21. A phenolic-base impregnating varnish, combined with a sheet cellulose filler and capable of bonding to urea resins, comprising the reaction product of a phenol and formaldehyde in the presence of a basic catalyst.

CLEANING METHOD. W. H. Colbert and A. R. Weinrich (to Libbey-Owens-Ford Glass Co.). U. S. 2,383,469, Aug. 28. A method for cleaning surfaces including those of plastic materials comprising subjecting to a preliminary cleaning, applying a removable liquid protecting covering of a high boiling liquid, removing by rubbing to a thin film, thus protecting against contamination, placing in a highly evacuated chamber to remove the liquid and then applying a coating to the cleaned surface by condensation while in the chamber.

TUBING. C. E. Slaughter (to Extruded Plastics, Inc.). U. S. 2,383,520, Aug. 28. A method for the fabrication of plastic tubing.

COATING. C. B. Hemming (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,383,548, Aug. 28. A flexible, heat and oil resistant coating comprising ethyl cellulose, ethyl alcohol, benzene, a toluene solution of castor-oil-modified glycerol sebacate, butyl stearate, heavy mineral oil, nigrosine oleate and a butyl-alcohol-modified urea-formaldehyde resin dissolved in butyl alcohol.

RESIN. R. W. Martin (to Hercules Powder Co.). U. S. 2,383,558, Aug. 28. A condensate resin comprising the product of heating a wood digestion resin with an aldehyde and doing so in the presence of a condensation catalyst.

LIGHT STENCIL. B. Rudnick (to Republic Aviation Corp.). U. S. 2,383,568. Aug. 28. A blank for the preparation of a light stencil comprising a transparent clear plastic sheet, a first coat of a cellulose acetate base lacquer mixed with aluminum acetate dust and a scribable coat of a light colored lacquer.

ADHESIVE. K. C. Roberts (to British Rubber Producers' Research Association). U. S. 2,383,569, Aug. 28. An adhesive comprising the simultaneous reaction product of rubber, maleic anhydride and a saturated monohydric alcohol.

RESIN. G. Spiller (to Hercules Powder Co.). U. S. 2,383,624, Aug. 28. A resin prepared by reacting a hard, oil-soluble resinous ester of pentaerythritol or polypentaerythritol with a rosin acid mixed with an unsaturated aliphatic acid.

TUBE. A. L. Parker (to Parker Appliance Co.). U. S. 2,383,733, Aug. 28. A flexible tubular structure comprising an inner rubber tube, a sleeve of braided glass fibers and an external coating of a flexible plastic material.

MOLDINGS. R. R. Bradshaw (to Dow Chemical Co.). U. S. 2,383,765, Aug. 28. A molded object having a nacreous sheen consisting of polystyrene having incorporated therein a sodium, potassium or magnesium salt of a sulfonated alkyl alcohol.

BRAKE LINING. M. T. Harvey (to Harvel Research Corp.). U. S. 2,383,790, Aug. 28. A brake lining comprising asbestos, organic friction material and a phenolaldehyde resin blinder, the friction material comprising ground particles of a furfuryl alcohol-furfuryl aldehyde condensate.

CONDENSATE. M. T. Harvey (to Harvel Research Corp.). U. S. 2,383,791, Aug. 28. The condensation product of maleic anhydride with a liquid obtained by condensing formaldehyde and a monomeric terpene alcohol.

RESIN. M. T. Harvey (to Harvel Research Corp.). U. S. 2,383,792, Aug. 28. A composition comprising a protein dissolved in a liquid furfuryl alcohol-formaldehyde resin.

RESINS. M. T. Harvey and R. F. Durst (to Harvel Research Corp.). U. S. 2,383,793, Aug. 28. A resinous product obtained by reacting glyoxal or polyglyoxal with furfuryl alcohol or polymerized acid condensates of furfuryl alcohol.

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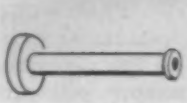

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BOOKS AND BOOKLETS

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery. Other books will be sent post-paid at the publishers' advertised prices.

"A.S.T.M. Standards on Plastics" (third edition)

Compiled and published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa., 1945

Price $2.75 ($1.80 for members) 550 pages

More than 100 specifications and tests developed by the Society through intensive work on the part of its Committees D-20 on Plastics and D-9 on Electrical Insulating Materials are provided in convenient form in this edition.

Among the titles listed are Specifications Covering: Molding Compounds, Nonrigid Plastics, Radio Applications; Methods of Test covering such subjects as accelerated weathering, arc resistance, dielectric constant, shear strength, Young's modulus in flexure; Recommended Practice for: tension tests, long-time, designation of numerical requirements in standards; and Nomenclature and Definitions of Terms Relating to: descriptive nomenclature, rheological properties of matter and characteristics of standard carbon arc accelerated weathering unit.

Chemical Engineering Catalog, the Process Industries' Catalog, 1945-46, Thirtieth Edition

Published annually in August by Reinhold Publishing Corp., 330 W. 42nd St., New York 18, N. Y., 1945

Price $3.00 1708 pages

Inaugurated by the American Institute of Chemical Engineers, the catalog provides a collected source of condensed and standardized data on equipment, machinery, raw materials, heavy and fine chemicals, and laboratory supplies used in the industries employing chemical process of manufacture. Included are classified indices of equipment and materials, carefully cross-referenced; and a Technical and Scientific Books Section cataloging and describing briefly a selected list of books on chemical and related subjects.

Plastics Applied

Edited by V. E. Yarsley, D.Sc., M.Sc., F.R.I.C.

Published by the National Trade Press, Ltd., London, England, 1945

Price, 42/-net 392 pages

The newcomer to the plastics field both in the United States and in Great Britain will find this book a very readable and informative volume. Edited by one of the leading British plastics consultants, it is a comprehensive reference on plastics and features in addition to technical and statistical material, a symposium of 31 articles by specialists, each of which discusses applications of plastics in specific industries. This approach is of value to the businessman or layman who is seeking information about any single outlet for plastics.

In addition to this analysis of plastics applications, design and color possibilities of plastics are outlined, health and safety precautions for industry workers are suggested, and there are selected tables of properties, formulations, lists of trade names and suppliers, along with an appendix containing advertisements of British plastics material producers, molders, machinery suppliers, etc.

Of special interest is the introduction written by Mr. Yarsley and E. G. Couzens, well-known British plastics author and research chemist, in which the development of plastics both in Britain and this country is reported. Plastics materials are briefly defined and surveyed in terms of end usage and in relation to other materials. Emphasis is on sound use of plastics and good design and, while selling points of plastics are stressed, the editor does not hesitate to counteract the idea of plastics as "miracle materials." H. B. J.

★ WATERTOWN MFG. CO., WATERtown, Conn., has prepared a "Book of Plastics" which gives a fairly complete picture of all phases of plastics molding in easy-to-understand text and illustrations. A materials section describes each plastic and evaluates it for various applications. The catalog distinguishes between the principal molding methods and explains finishing and assembly operations. The photographs are particularly lucid in this section. Also included in the booklet are engineering considerations and x-ray methods; special laboratory equipment; a plastic properties chart and a plastics comparator table.

★ "STATISTICAL ANALYSIS OF Test Data," Technical Bulletin No. 773, published by Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J., deals with statistical methods for quality control in production and the analysis of experimental data. The paper points out fields of application without including detailed mathematical methods.

A second booklet from the same company, designated Technical Bulletin No. 770 and entitled "Microscopical Techniques for the Study of Dyeing," gives data for examining textiles, including synthetics, before and after dyeing. Cross-sectioning textiles, cross-sectioning leather, color photomicrography, microscopical illumination and optical staining are discussed among other topics. Three color plates show photomicrographs of textile fibers, dyed leathers and miscellaneous specimens.

★ DUREZ PLASTICS & CHEMICALS, Inc., North Tonawanda, N. Y., has released a booklet giving complete technical data on Durez casting resin, including illustrations of applications. Fundamental instructions on patterns, mold making and mold preparation, on the mixing of resin with catalyst and fillers, on curing or baking, fillers, wooden cores, inserts, shields for plating, finishing and colored cast resin are included.

★ "SYNTHETIC ORGANIC CHEMIcals," catalog and reference manual of industrial and aliphatic chemistry published by Carbide & Carbon Chemicals Corp., New York 17, N. Y., has recently entered its 12th edition. In condensed form the booklet (F-4372) presents information on the properties, uses and specifications of some 160 products sold by the corporation. Thirty-four products not included previously are found in this latest edition which contains new chapters on acetals, sulfur compounds, polyethylene glycols, hydroxyethyl cellulose, plasticizers.

★ A REVISED EDITION OF THE technical reference booklet on cellulose acetate, recently issued by Hercules Powder Co., Wilmington 99, Del., brings up-to-date fundamental literature on the three major bases for cellulosic plastics. Part one is concerned with the manufacture and general and specific properties, while the second part describes uses of cellulose acetate in solutions and plastics, adding a new section on thermoplastic laminates. Also discussed in this edition are the improved dimensional stability and greater water resistance of plastics made from high acetyl acetate.

★ A TWO-SECTION PAMPHLET (Bulletins 23 and 23A) from Durite Plastics, Inc., Philadelphia 24, Pa., covers the subject of a room-temperature-setting resorcinol resin glue known as Durite 3026. The first part tells about general and specific properties, as well as mixing instructions, storage, spreading, open and closed assembly time, pressure requirements, pressure period and precautions to be observed. In the second half special coagents, the use of the resin glue with coagents and special applications are treated.

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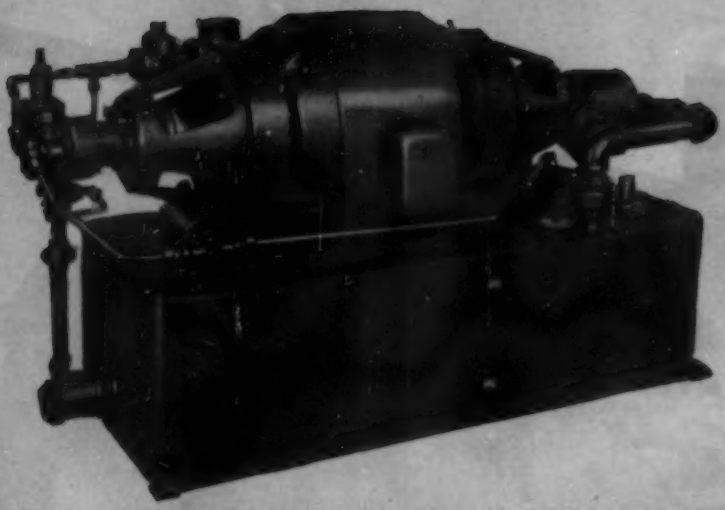

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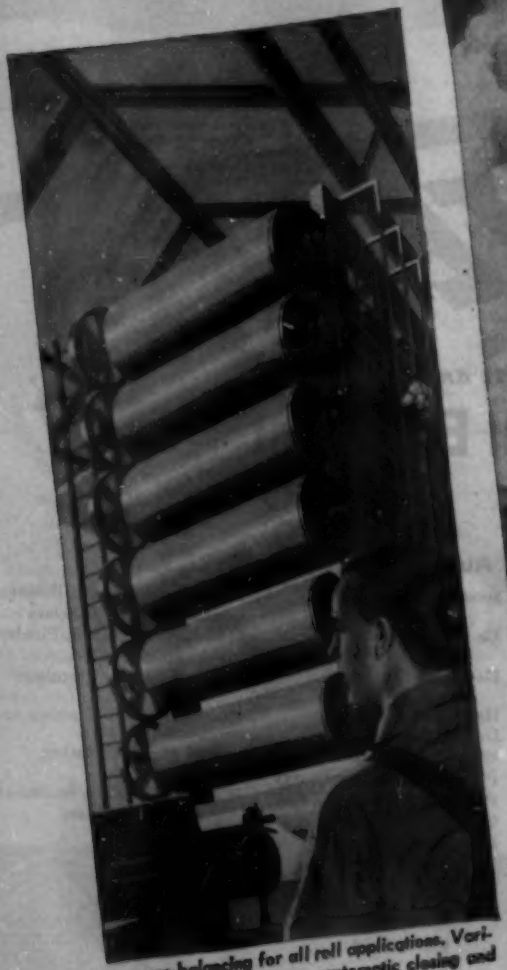

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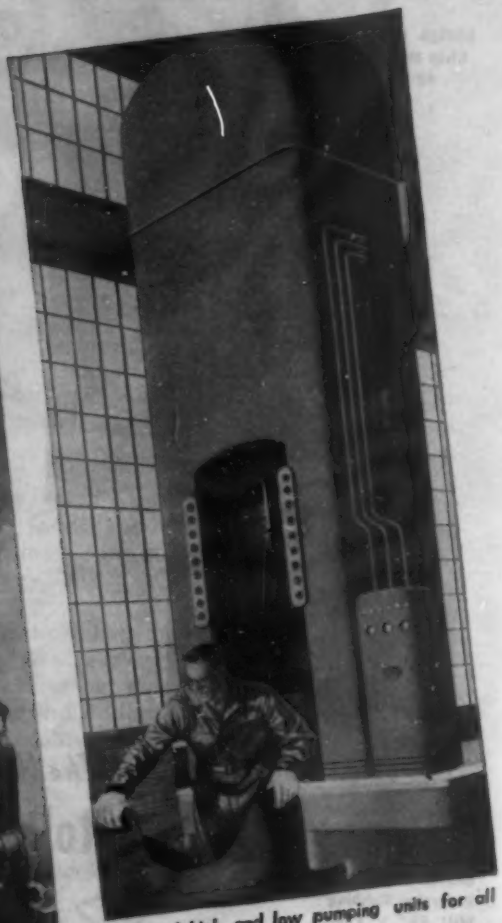

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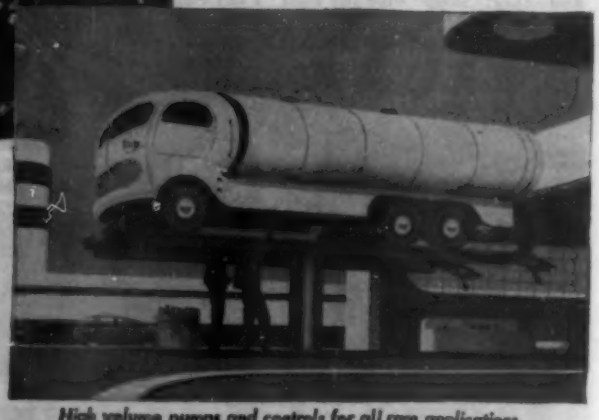

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BULLETIN 23

Plastics Bulletin 23 (recently announced) has been withheld in order to include a vitally important addition to the Olsen line of Plastics Testing Equipment. If you have requested a copy and have not received it, we ask your forbearance. If not, write today to reserve your copy which will appear in the very near future.

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If you would like to present your problem in person, you are invited to do so. The committee meets regularly in Monsanto's Springfield, Massachusetts, conference room. Address all requests for questionnaires, information or appointments to: MONSANTO PLASTICS TECHNICAL COMMITTEE, MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts.

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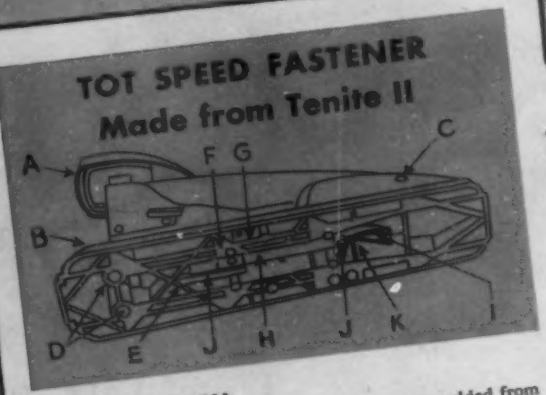
This TOT Speed Fastener illustrates Aico's adaptation of a familiar product to plastics manufacture. The simple, streamlined plastic base conceals an intricate pattern of walls, ribs and bosses—Aico-designed to save material and add strength.

Expert plastic engineering on problems like this one saves time and expense. Aico's 30-year experience with all molding materials and methods eliminates experimentation . . . clinches results.

TOT SPEED FASTENER
Made from Tenite II



TENITE II TOT SPEED FASTENER

MOLDING MATERIAL

Plastics parts of the TOT stapling machine are molded from black or 9498 brown Tenite II. This thermoplastic material is adaptable to the injection molding process and has the toughness necessary for the thin wall sections of the base. Tenite II has excellent stability under variations of temperature and humidity. It also has a fine finish and is pleasant to the touch.

MOLD DESIGN

The stapler cap (A) is produced in a four-cavity injection mold and the base (B) in a two-cavity mold. Holes (C) are provided in base for pin which attaches metal body to base. 2 holes (D) are for riveting metal pressure bar to base. The base (B) is hollowed to save material. Diagonal walls (E) intersect horizontal wall design for greater strength. Heavy sections (F) and ribs (G) serve the same purpose. Spring (H) and catch (I) of release mechanism fit between accurately molded plastic shoulders (J). Three short wall sections (K) on each side of handle converge for extra support at point of strain.

**This is No. 27 in Aico's file card series of plastics applications. Send a request on your letterhead for Nos. 1 to 27.*

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30th Year

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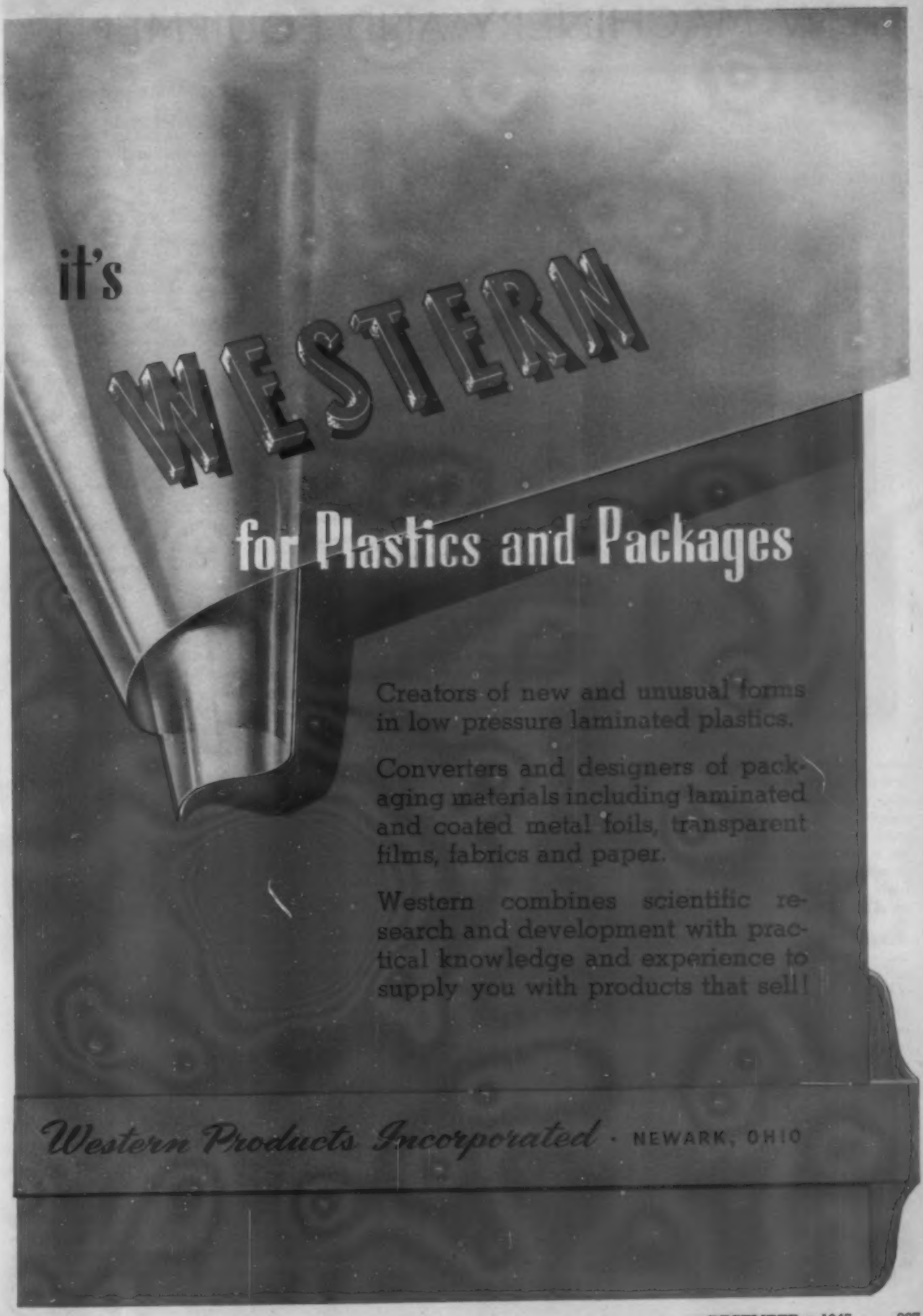
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NEW MACHINERY AND EQUIPMENT

★ THE PACEMAKER LABORATORY press is a new 2-oz. injection molding machine announced by Sav-Way Industries, Detroit 13, Mich., which is reported to be ideally suited to plastics research, development and instruction, preparation of samples and for small scale production. One hydraulic ram furnishes injection pressures up to 30,000 p.s.i. and at the

same time furnishes sufficient clamping pressure for mold surface areas of more than 4 sq. inches. This clamping is accomplished by means of a wedge-shaped mold and a mold support. The machine has a lower platen which measures 10 by 10 inches. It occupies 29 by 30 in. of floor space, is 6½ ft. high and has a gross weight of 1200 pounds.

★ THE SOUTHWARK DIVISION OF Baldwin Locomotive Works, Philadelphia 42, Pa., has announced the development of several new equipment items: 1) The SR-4 pressure sensitive device is used to convert gas or liquid pressure to electrical energy for measuring, recording or controlling. 2) A combination flexure tool and deflector for use in bending tests on molded and laminated plastics, and woods. The deflectometer measures deflection from the center of specimen and conveys this to an autographic stress-strainer recorder which gives the load deflection curve. An important feature of this deflectometer permits the operator to adjust magnification of deflection in multiples of 5, 10, 20, 50, 100 and 200 times. 3) A third new device, a ram pacer, is an attachment for standard hydraulic testing machines for plastics, metals, woods, etc., which gives control over crosshead movement at 8 pre-set speeds—0.01, 0.02, 0.05, 0.1, 0.2, 0.4, 0.5 and 1.0 in. per minute. These speeds are obtained by gear changes on the synchronous motor drive unit. 4) A wedge grip with replaceable file face for use in testing machines up to 300,000 lb. capacity is another new development. 5) A special plastics grip which is self-aligning, swiveling, and can be moved laterally, has been designed for use with the universal testing machine. Of 5000 lb. capacity, it weighs 4¼ lb., and its basic principle makes it good for gripping the glossy-hard surfaces of some plastics.

★ LEONARD ENGINEERING CO., Silver Spring, Md., has developed a new model of its Micro Scale which is designed to eliminate measuring mistakes, prevent eye strain and teach "green help" to do accurate work. This precision magnifying scale is used by chemists, draftsmen, artists, engineers, etc.

★ AIRTRONICS MFG. CO., LOS ANgeles, 26, Calif., has redesigned its line of preheaters to conform with the expressed desires of molders as obtained from a recent requirements survey. In addition to the established Airtronics features of dual load selection, automatic power regulation and automatic excitation regulation, the company's preheaters now are equipped with operating controls which are conveniently located, "disappearing" set-up controls, removable, hinged inspection doors, electrodes to accommodate wider variety of loads, and other features.

★ A NEW CONTROLLED HUMIDity and low temperature test cabinet with a self-contained refrigeration system is being manufactured by Northern Laboratories, Ltd., Long Island City 2, N. Y. A high degree of accuracy can be maintained through the medium of two separate potentiometer thermocouple indicating controllers which are sensitive to minute changes in temperature and are mounted on a standard communications relay rack cabinet with a 10-ft. multi-electrode cable and plug assembly for plug in on the cabinet. Temperature range is −50° C. to +60° C., while humidity conditions on 10 percent R.H. to 95 percent R.H. may be held nearly constant above 3° C. The test cabinet is completely automatic and is also portable.

★ TWO NEW PORTABLE INFRAred units have been introduced by the Carbomatic Corp., New York 19, N. Y., for use with reflector type lamps in any size. Model W6, designed for 6 lamps, and Model R12 for 12 lamps, are made of heavy gage metal, and are designed to give complete flexibility so that the lamps may be adjusted at any angle or in any position which may be desired.

★ THE BELLOWS CO., AKRON 10, O., is introducing a new "stepless-range" power feed for use on drill presses, milling machines, surface grinders, etc. This new Bellows-Senacon drill press feed is powered by the Bellows air motor and operates on any air pressure up to 160 pounds. Feeding rate can be adjusted to fit stock or tool needs. Precision controls for feed and traverse rate, power thrust, length of stroke are simple and positive. The Hydro-Check, a hydraulic resistance unit which is not standard equipment on this power feed, but is available in six sizes, provides a constantly maintained feed rate regardless of fluctuations in stock hardness.

★ A TOUGH WEB OF NEOPRENE synthetic rubber which keeps the hardened steel jaws in better alignment and permits wider range of drill sizes, is a feature of the new Rubber-Flex production chucks made by Jacobs Mfg. Co., Hartford 2, Conn. The neoprene replaces the flexible spring steel collet shank of the traditional single-purpose type of drill chuck. A compact, conical unit is

achieved by bonding the resilient material to the steel jaws and passing it through anchoring holes, then tightened by a screw mechanism which forces it forward into the nose of the chuck. When the chuck is loosened for changing drills, the neoprene web pushes the jaws apart and releases the drill shank. (*Please turn to next page*)

BAKER PLASTICIZERS

IMPART

Retained Flexibility

TO

VINYL RESINS — CELLULOSE RESINS

PHENOL FORMALDEHYDE RESINS

MELAMINE RESINS — STYRENE RESINS

UREA FORMALDEHYDE RESINS

AND

GR-S — GR-N — GR-M

THE BAKER CASTOR OIL COMPANY

Established 1857

120 Broadway, New York 5, New York

Chicago, Illinois — Los Angeles, California

★ THE IMPROVED VAPORTRON self-regulating AC electric steam generators to take the place of a central steam boiler, have now been made available by AAA Mfg. Co., Waltham 54, Mass., for installation on plastic presses, tire recapping and retreading molds, cooking kettles, sterilizers and for any other use where a steady supply of dry steam is required up to $1^1/_2$ boiler hp. capacity and pressure up to 150 pounds. These machines are light and compact, requiring only 14 by 21 in. of floor space and weighing 150 pounds, and operate on 220 volt, 3-phase 60 cycle AC connected in delta or 440 volt, 3-phase 60 cycle AC connected in wye.

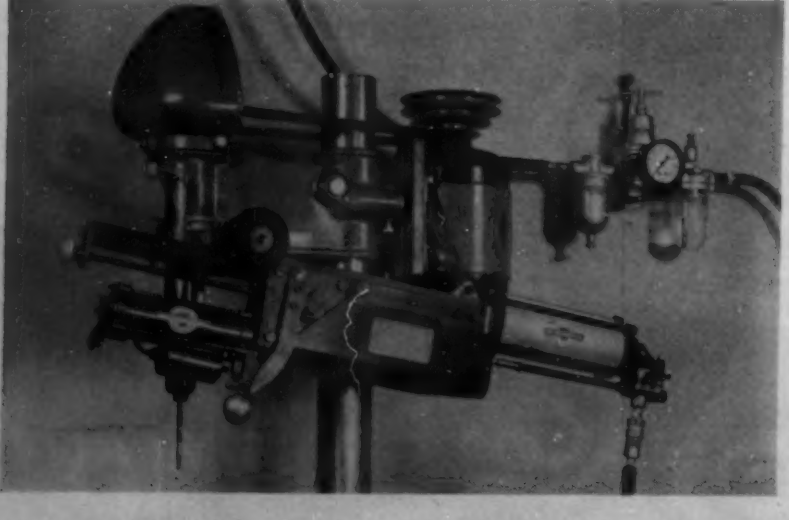
★ A NEW AUTOMATIC ELECtronic gaging instrument, capable of automatically gaging a wide variety of small parts either metal, plastic, ceramic, glass or paper, has been developed by The Autotron Co., Danville, Ill. The machine automatically gages depth of holes, external lengths and outside diameters to very close tolerances with high precision and operates at a speed upward of 3300 pieces per hour. Speed of the machine is determined by the size, shape and manner in which the part to be gaged is handled.

★ W. T. LA ROSE & ASSOCIATES, Troy, N. Y., have brought out a small high frequency preheating unit, called Bantam "Thermall," which is 14 in. wide, 22 in. deep and 34 in. high. A heating rate of 16 oz. of compound to 250° F. in 1 min. is easily maintained and, in actual production, the unit is capable of handling loads up to 45 oz. per minute. This Bantam model is said to cut molding cure time, practically eliminate rejects and minimize mold breakdown. The company also manufactures two other types of preheating units.

★ A CONSTANT TEMPERATURE and plastic melting tank which lends itself to a variety of uses in industrial and research laboratories, is a new product of Laboratory Specialties, Inc., Wabash, Ind. Constructed of welded steel and surrounded by transite insulating material, it is provided with immersion-type heating elements of 2000 watts capacity, cooling coils, an electric stirrer and dual temperature controls for maintaining plating or metal treating solutions of any specified degree between temperature of the cooling liquid and 400° F. Capacity of this tank is 11 gallons.

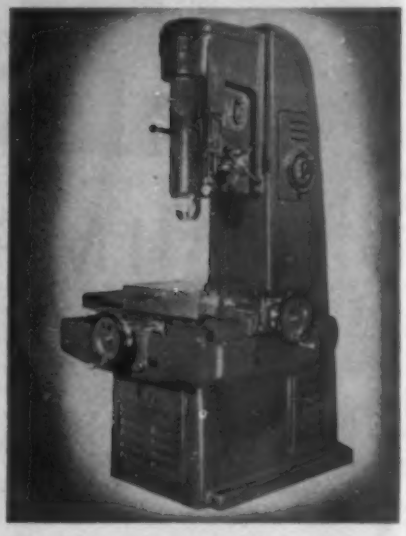
★ THE MEAD INDUSTRIAL BURRing machine Model OB is manufactured by Mead Specialties Co., Chicago 41, Ill. This machine can be used for either outside or inside grinding and is said to have a wide range of utility—from snagging rough castings weighing up to several pounds to the most delicate of finishing and polishing operations. With an overall height of 21 in. and a base which is 6 by 12 in. in size, this burring machine comes equipped with a work table measuring $7^3/_4$ by $7^3/_4$ inches.

★ DETROIT SURFACING MACHINE Co., Detroit 4, Mich., has announced its new models, XL50 and XL90 Easy reciprocating electric sanders, for new and refinishing work on plastics, metals and wood surfaces. They feature a floating pistol-grip type handle mounted on rubber with a perfected balancing slide-type switch and a more powerful motor. The company has retained the straight-line, reciprocating action that mechanically duplicates the back and forth motion that is characteristic of hand block sanding, rubbing or polishing.



★ DUAL PURPOSE BEMISINE dresser, a new device for dressing precise angles on surface grinder wheels, has been announced by Nichols-Morris Corp., New York 7, N. Y. A precision-fitted sliding member carrying a diamond dressing tool is mounted on an adjustable sine-angle plate which locates on the magnetic chuck directly below the grinding wheel. After the desired angle is determined, the diamond tool is brought in contact with the wheel and the slide moved back and forth manually to generate a corresponding angle on the wheel.

★ KEARNEY & TRECKER PRODucts Corp., Milwaukee, Wis., has just announced the new Model C Milwaukee Autometric Boring Machine which it has developed to handle a wide variety of precision boring operations. A stationary boring spindle head is mounted on the machine column, thereby providing an extra long bearing for the spindle quill. The ingenious construction of the head, spindle, and quill permit sufficient quill travel to take care of the entire vertical range of the



machine without increasing the over-all machine height. An ample range of spindle speeds and quill feeds insures efficient use of modern cutting tools on a wide variety of hole diameters, regardless of the material being bored. The precise transverse and longitudinal movements of the table are effected by precision measuring screws equipped with large diameter micrometer dials and verniers graduated to read to 0.0001 inch. The designer and manufacturer of this machine has placed stress on accuracy, rigidity, compactness, range and simplified operation.

★ NALCO CARBON FILAMENT lamps, according to the manufacturer, North American Electric Lamp Co., St. Louis, Mo., are now supplied with a mechanical joint between base and bulb to provide a permanent seal under all circumstances. This seal eliminates the need for cements or other binders and assures maximum lamp life, even under the terrific heat of infrared tunnel installations. The clear type lamp is obtainable in 128, 250, 375 and 500 watts, and the inside silvered R-40 lamps in 128, 250 and 375 watts.

★ THE AIR MASTER, A DUST COLlecting unit for grinding and buffing wheels, is manufactured in three sizes, one of which will fit practically any type or make of grinder or buffer. The unit, according to Cincinnati Electrical Tool Co., Cincinnati 8, Ohio, its manufacturer, not only removes grit and dust from the wheels, but protects machine tools against damage from abrasives.

MOSINEE, the "proved-in-service" material for products and packaging, provides advantages that open the way to many markets . . . for MOSINEE can be engineered to include definite essential paper properties: dielectric strength — uniform density — tensile strength — pliability — water repellency — controlled acidity and alkalinity — or other technical characteristics that might add outstanding value to your products.

More and more, product engineering is taking into consideration the advanced potentials of MOSINEE. Through cooperation with the "paperologists" of The Mills of Mosinee, many manufacturers and converters have improved the quality of their products, broadened utility, lowered cost, expanded present markets and opened new ones.

The Mosinee laboratories, efficient production facilities, and paper engineering leadership are prepared to cooperate in creating specific types of MOSINEE for your products, or in improving your processing.

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Please address your letter "Attention Dept. A"

NEWS OF THE INDUSTRY

★ B. W. MARTIN, PRESIDENT OF Shellmar Products Co., Mt. Vernon, O., and Southgate, Calif., has announced two important personnel acquisitions with the company's expanding activities in the plastics and packaging fields. They are: T. R. Baxter, package development manager and T. K. Almroth, director of public relations.

★ ELMER E. MILLS, PRESIDENT of Elmer E. Mills Corp., Chicago, Ill., has announced the resignation of C. W. Marsellus.

★ WILLIAM McNEAR RAND WAS elected president of Monsanto Chemical Co., St. Louis, Mo., on September 25. Mr. Rand, a vice-president of the company since late 1943, succeeds Charles Belknap who will continue with Monsanto as chairman of its Executive Committee.

The company has recently announced it had listed 151 construction and expansion projects involving an estimated $48,400,000, some of which include new or expanded facilities for chemicals already in production, production of entirely new chemicals, new pilot plants, power plants, office structures and research laboratories.

★ CHARLES W. KLEIDERER, FORmerly production and development engineer in charge of plastics for the radio proximity fuze at Johns Hopkins University, and inventor of the new plastic material "Cliderite," has been named director of research, Ideal Plastics Corp., Div. of Ideal Novelty & Toy Co., Long Island City, N. Y.

GEORGE H. SOLLENBERGER

★ GEORGE H. SOLLENBERGER, former acting chief of the Plastics Branch of the War Production Board, has returned to Rohm & Haas Co., Philadelphia, Pennsylvania.

★ MASTER PLASTICS, INC., WILmington, Del., has been formed by Joseph S. Tatnell, formerly in the Plastics Branch of WPB, and Edward W. Maass. The company will produce low pressure laminates and is working exclusively on artificial legs at the present time. Both men have been with National Vulcanized Fiber for a number of years.

★ WESTERN PRODUCTS, INC., OF Newark, O., converter of flexible packaging materials and manufacturer of low pressure laminated plastics, has announced the purchase of the Newark plant of Burke Golf Co. Western Products has already moved into its new quarters which afford about 70,000 sq. ft. of manufacturing space.

★ IN ORDER TO ENLARGE HIS scope of service on product, plastic mold and machinery designs, George W. DeBell, Stamford, Conn., has increased his staff of designers.

★ HAROLD NARCUS, CONSULTING chemist in plastics and electroplating fields, has announced the formation of Electrochemical Industries in Worcester, Mass. The company will specialize in plating of plastics and other non-conductors. This new company will also provide a consulting service to the plastics industry as well as to the plating fields.

★ THE PLASTICS INDUSTRY'S Joint Wartime Technical Committee, established to coordinate the wartime activities of the plastics industry, was disbanded by an unanimous vote of the Executive Committee since the need for it no longer exists.

★ ANNOUNCEMENT HAS BEEN made of the formation of a new research and merchandising group, known as the Wood-Ply Research Foundation, Inc., with headquarters in Chicago. This news was released at a showing of Veriply products. Objectives of the Foundation include development and merchandising of new plywood and plastic products which are expected to be used in a wide range of industries.

★ H. E. FLOOD, FORMERLY CHIEF chemist of the Loalin Div., has been appointed director of research for Catalin Corp., New York, N. Y.

★ ROYDEN C. RINKER, E. BOWman Stratton, Jr., and Bill Swick have been appointed to the staff of Penacolite Div., Pennsylvania Coal Products Co., Petrolia, Pa. Mr. Rinker will be engaged in resin research (he was formerly in the Plastics Section of the National Bureau of Standards and with the Dept. of Agriculture); Mr. Stratton in special products sales development; and Mr. Swick in adhesive sales.

★ ACCORDING TO AN ANNOUNCEment by J. B. Wiesel, director of sales and development for Cellulose Products Dept., Hercules Powder Co., Wilmington, Del., LeRoy T. Barnette has been named supervisor of branch offices; J. K. Speicher, assistant technical service manager; and L. C. Kleinhaus, manager of the department's New York office.

★ OPERATIONS ARE NOW UNDER way at the plant of Dover Industries, Inc., Chicago 8, Ill., which was organized for the manufacturing and jobbing of metal articles requiring plating.

★ TWO NEW ADDITIONS HAVE been made to General Electric's growing list of plants according to recent company announcements. One is the Chemical Engineering Div. which will be part of General Electric's Chemical Dept. at Pittsfield, Mass. The second is its new silicone plant to be built at Waterford, N. Y., which will eventually be the center of the Chemical Department's resin and insulation materials division.

★ WAYNE BRINKERHOFF, former manager of technical data service, has been named advertising manager, B. F. Goodrich Chemical Co., Cleveland, Ohio.

★ ROBERT L. RICHARDS SUCceeds Charles A. Cary as manager of the Nylon Div., E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. Arlington Kunsman, former director of production of the Rayon Div., has succeeded to the position of assistant manager of the Cellophane Div. formerly held by Mr. Richards.

★ DC 996 SILICONE VARNISH, A heat stable, waterproof varnish for impregnating electrical equipment, is a new product of Dow Corning Corp., Midland, Michigan.

★ INVENTOR AND DEVELOPER, George C. Grinnell has announced through George C. Grinnell & Assoc., Quincy, Mass., an expanded program in the mechanical binding field.

Sorry!

★ IN THE ARTICLE "FABRICATing with frictional heat" which appeared on pages 142 to 145 in the November issue we failed to mention that the material was from a speech presented by Robert N. Freres, mechanical engineer, Rochester Button Co., before the New England Section of Society of Plastics Industry on Oct. 16 at Manchester, Vt.

MEET METAL PLASTIC ENGINEERING

Planned Perfection

A Short Order Department bridges the gap between a sample and production. It can be an economical means of trying out a new idea on a semi-production basis. It has many other uses too, such as short runs of special equipment, sample orders, etc. So whether it is ten pieces or ten thousand Cinch Short Order Service Department . . . complete in every detail, metal, plastic or assemblies . . . has been a boon to our customers for those overnight "hurry up" change overs. Nearly every manufacturing business has such problems. We are glad to have helped in countless such emergencies. Perhaps you too owe it to your company to investigate our facilities.

No. 6 in a Series of Advertisements "MEET MEtal Plastic Engineering"

CINCH MANUFACTURING CORPORATION

2335 W. Van Buren Street, Chicago 12, Illinois

Subsidiary of United-Carr Fastener Corp., Cambridge, Mass.

"Birthplace of the future"

Research facilities to handle designing and engineering problems for the small manufacturer will be offered by a technological research center soon to be constructed

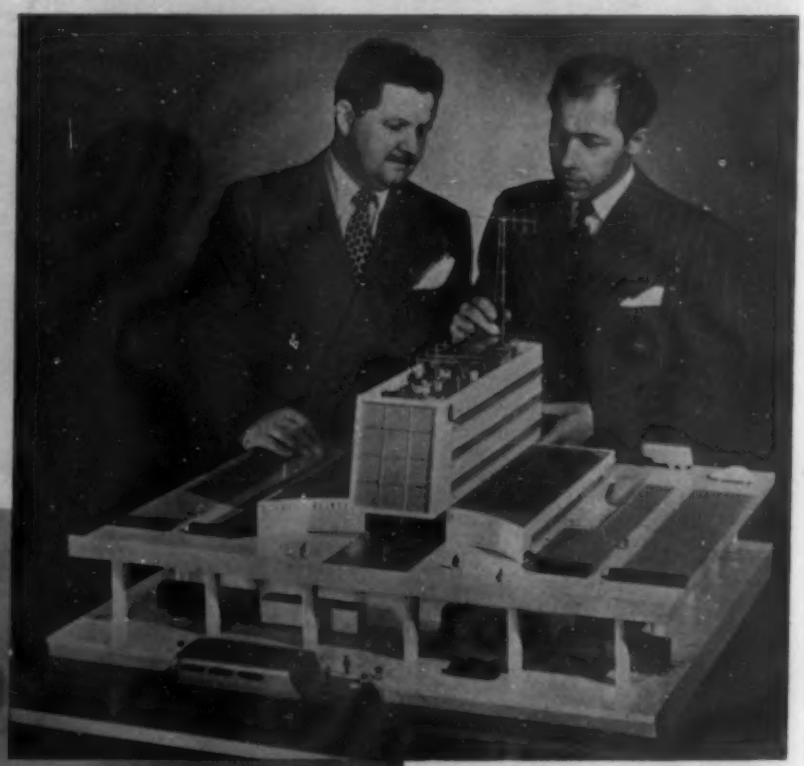
What is said to be the first technological research center in the United States capable of handling all designing and engineering problems will be built in Chicago next year. Barnes & Reinecke, industrial designing firm, has announced plans for the project—a gleaming white, two-million-dollar "university of skills" to be located as near Chicago's loop as possible. Construction of the project will begin in 1946, as soon as site, labor and materials become available.

James F. Barnes, one of the firm partners, said Techmart will function to provide small- and medium-sized business with research facilities which will enable such business to compete with major industrial concerns. In fact, it is designed to work for many manufacturers in various fields of small industry in much the same manner as a large research department functions for the giant organization of which it is such an integral part.

"A small business organization, confronted with a problem in improving its product or designing a new one, would have to turn to experts in perhaps a half dozen fields," Barnes explained. "No small business firm could afford to build and maintain a staff and equipment qualified to deal with such problems." But any such businessman will be able to come to Techmart and shop for the particular experts he needs, Barnes pointed out. There will be experts in electronics, chemical engineering, model making, product creation, plant design and engineering, food technology, package development, product design and special machine design.

The new home of the firm will cover a full city block with provisions for access to rail, water and motor transport. The first floor structure will house various laboratories. An overhanging deck, supported by white pillars, will hold two modernistic wings containing departments for plastic engineering, television and other sections. Mounted between the wings will be a four-story structure in glass, stainless steel and stone, resembling a palatial ocean liner. On the roof, the design calls for a television antenna and a recreation center.

PHOTOS, COURTESY BARNES & REINECKE



1—Scale model of Techmart, proposed ultra-modern research center, is inspected by the partners James F. Barnes and Jean O. Reinecke

2—Rear view of the model illustrates how the two-million-dollar building will be served by rail facilities at both front and rear, and at the same time will be accessible by car and boat

It Joins Any Materials!

Picked at random you see a few of the thousands of adhesive problems Pliobond is being called upon to solve. Perhaps it can help *you* too.

"We have a problem cementing a cadmium plated steel piece to a painted surface..."

"The particular problem we have in mind is one of a suita[illegible] for two ceramic parts..."

"We are particularly interested at this time in bonding fabric belting together to make it endless."

"What we are after is an adhesive that would rigidly hold the curved zinc in place..."

"My main trouble is the bonding of the aluminum to the plastic."

"I would be interested in receiving full information, particularly as to the bonding of a cement asbestos sheet with insulation material."

"We have two instances where we wish to use such a cement. One is to bond soft Vinyls together and to bond hard Vinyls."

"...also information regarding its adaptability to marine use and to laminated timbers to be used under extreme moisture conditions."

This new, quick-setting plastic adhesive offers truly unique advantages. One agent, Pliobond, firmly joins any materials ... like or unlike ... metals, plastics, fabrics, glass, rubber, wood, paper, leather, ceramics.

In addition, it's strong, permanent, withstands constant flexing, is immune to fungi and resists water, oils, and wax.

Write us for technical information directed to your own adhesive requirements.

Pliobond

BONDS ANYTHING TO ANYTHING!

UNITED STATES PLYWOOD CORPORATION ... Exclusive Distributors

Industrial Adhesives Division: 55 West 44th Street, New York 18, N. Y. • Branches in Principal Cities

PLIOBOND is a product of* THE GOODYEAR TIRE & RUBBER COMPANY • *Trademark registered, The Goodyear Tire & Rubber Company

PHOTOS, COURTESY DURITE PLASTICS, INC.

1—*Improved weatherability is one of the advantages accruing from the addition of aminoplast resins to plaster of Paris compounds. This resin-indurated plaster eagle also has greater strength and dimensional stability*

Resin-strengthened plaster of Paris

THE eagle that spread its wings to a full six and a half feet in a recent window display at Macy's in connection with the opening of the Eighth War Loan Drive is typical of the work that is being done with plaster of Paris indurated with thermosetting resins. By mixing Durite aminoplast resins with plaster, the Voigt Co. was able to impart to this eagle a maximum resistance to weathering while maintaining all the advantages inherent in the plaster itself.

The popularity of plaster of Paris for display novelties, statues, decorative pieces, for patterns, checking fixtures, form blocks and stretch press dies, is based upon the short time that is required for the preparation of the material, on its readiness for application immediately after mixing with water and on its fast setting after shaping or casting. But the material suffers somewhat from low strength, brittleness, high water absorption and a tendency to disintegrate somewhat when it is exposed to high humidity or to weak acid.

The addition of synthetic resins to plaster of Paris compounds has gone far toward overcoming these deficiencies. For example, the small figurines pictured in Fig. 2, the products of Kleiner Studios, are more durable and charming in appearance than the general run of straight plaster of Paris decorative pieces. And, when the same aminoplast resins that are used in these statues are incorporated in solid decorative plaster applications requiring metal inserts, the danger of breakage due to expansion and contraction is practically eliminated.

2—*The color of these figurines was in no way affected by the use of aminoplast resin in the plaster from which they were formed. And they do have greater strength*

Aminoplast and resorcinol resins

There are two types of Durite resins available for plaster induration. One, aminoplast, cures at heats ranging upward to 175° F.; the other, resorcinol, at room temperature. In the production of such pieces as the eagle (Fig. 1), the resin is combined with the plaster during the mixing cycle. This addition does not in any way change the behavior or workability of the mix over that of plain plaster in the molding stage and through to the initial set. Once dried and cured, however, the resemblance ceases. Besides improving surface appearance and hardness, the addition of these resins has been found to produce a finished part with physical strength up to five times that of ordinary plaster products.

These resins are not necessarily compounded with the plaster prior to molding. It is also possible to impregnate the products after they have been formed by dipping, spraying or brushing.

While aminoplast resins are preferred for use with decorative plaster of Paris objects because of their lack of color, resorcinol resins are the usual choice of the industrialist. In this field the dimensional stability and increased physical strength of resin impregnated plaster assure relatively inexpensive yet highly efficient checking fixtures, formblocks and laminating mandrels.

RUBBER and PLASTICS TESTING EQUIPMENT by "PRECISION"

To its present line of over 2,500 items of Scientific Research and Production Control Equipment, "Precision" introduces a complete line of Rubber and Plastics testing apparatus. Shown below are a few representative items. "Performance Tested" and approved by our own and other leading laboratories throughout the country, this equipment embodies the same engineering features and high standards of workmanship found in all other "Precision Products".

"PRECISION"-SHELL CONTINUOUS FLOW REFRACTOMETER
Indicates purity thru refractive index. Connected directly into processing pipeline.

AGING JIG
Naval Research Laboratory Rubber Seal Aging Test Jig. Used to test rubber gaskets to specification 33R9 INT. Duplicates service conditions.

PERMANENT SET TESTING APPARATUS
For tension testing of rubber. ASTM D-412-41 and Federal Specification ZZR-601. Holds 6 samples. Individual clutches for each sample.

CRESCENT TEAR TEST JIG
Used for slitting the crescent tear test pieces according to A.S.T.M. D-624. The slitting depth gage on the right also furnished.

FLOW TESTER ASTM D-530
For measuring flow of hard rubber and plastic under pressure. Equipped with dial indicator.

PRECISION TEAR TESTER
Utilizes 3/4" diameter disc sample died from regular tensile slab. Fits standard tensile machines. Consistent and rapid in operation. Duplicates service conditions.

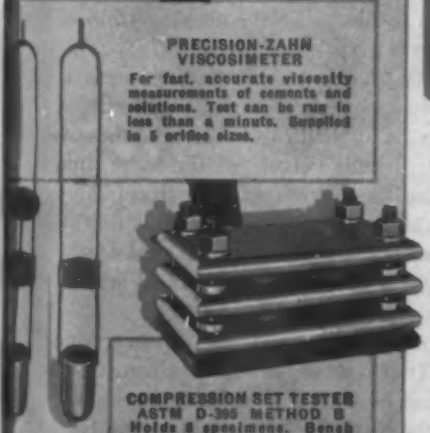
DIES
Dies of all sizes for tensile and tear tests, including 2" x 1/2", 2" x 1/4", 1" x 1/4", 6" x 1", and 1.129" diameter. All to ASTM specifications.

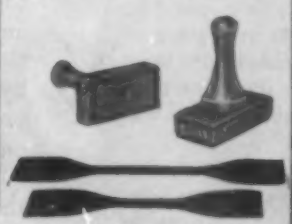
DIE BLOCK
For cutting tensile test pieces. Made from carefully selected end maple 9" square. Convenient 3 ft. height. Mounted on sponge rubber to absorb shock.

MALLET
For dicing test samples. Durable rawhide shockproof construction.

"PRECISION"-SHELL BUTADIENE ANALYZER
Determines butadiene by Gas-Volumetric Method.

PRECISION-ZAHN VISCOSIMETER
For fast, accurate viscosity measurements of cements and solutions. Test can be run in less than a minute. Supplied in 5 orifice sizes.





COMPRESSION SET TESTER ASTM D-395 METHOD B
Holds 8 specimens. Bench plate makes this apparatus extremely easy to handle. The usual spacers are replaced with washers which cannot become lost.

COMPRESSION FATIGUE CELLS
Used to confine rubber under compression for long periods during which time compression fatigue is measured by observing the decrease in the pressure exerted by the sample.

GAGE MARKER
For marking elongating marks on tensile test pieces makes both the 2" and 1" marks. Fine line produces less error. Light weight, made to fit the hand.

"PRECISION"-BASHORE RESILIOMETER
A necessity for synthetic development and compounding since resilience can no longer be taken for granted in an elastomeric compound.

SEE YOUR LABORATORY SUPPLY DEALER

SEND FOR BULLETIN NO. 1005-6

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1736-54 N. Springfield Ave., Chicago 47, U.S.A.

★ *Engineers and Builders of Scientific Apparatus and* ★

Production Control Laboratory Equipment for Almost a Quarter Century

Polythene, aid to radar

by JOHN LANGDON-DAVIES, M.B.E.*

WHEN in 1931 Imperial Chemical Industries set two scientists to work to discover what would happen to various chemical substances when they were subjected to very high pressures, there was no particular practical object in view. It was simply one of those pieces of fundamental scientific research for which British scientists have always had a peculiar aptitude.

Everybody knows that chemicals tend to behave differently at very high temperatures or at very low temperatures from the way in which they react in normal conditions. For example, when a temperature approaching absolute zero is reached, metals have practically no resistance to an electric current, so that if electrical cables could be kept at these very low temperatures, the loss of power in conveying current across country would be very small indeed. It seemed possible, therefore, that if various substances were compressed under unusually heavy weights of anything from 15,000 to 300,000 p.s.i., something useful might result.

The experiments which went on for two years were completely disappointing. All sorts of gases were compressed—to no purpose. But in 1933, after exerting a pressure of many thousands of pounds to the square inch on ethylene gas, the men engaged in this experimental work noticed a minute trace of a white solid left in the container.

Further investigation showed that 500 or more of the ultramicroscopic units of which ethylene gas consists had become stuck together as a result of the abnormal pressure, and it seemed quite possible that the new substance, polythene, might turn out to have new chemical and physical properties of a useful nature. What the two scientists could not know was that they had hit upon an ideal adjunct to the development of radar—because in 1933 radar was itself a thing of the future.

By 1935 they had enough polythene to show that it had qualities of toughness, flexibility, water resistance and lightness in combination with electrical properties which would make it invaluable for submarine cables and for cables carrying high frequencies used in television. The technicians of the Telegraph Construction and Maintenance Company, when they were called in, realized that here was something that could be made in a laboratory with even better properties than gutta-percha, and in July 1939 a mile of submarine cable was constructed using polythene for insulation purposes.

On the day that Germany invaded Poland, I.C.I. constructed a full-sized unit for manufacturing the new substance, but before a single pound of polythene could be manufactured, it was seen that war needs were going to be very great and the apparatus was doubled. By then, radar had come into its own and just after the outbreak of World War II, a ton of polythene-insulated cable was manufactured for radar apparatus.

Television and radio are going to expand enormously in the next 10 years; polythene will be there to help, thanks very largely to the necessities of war. We can be quite certain of two things. First, that many further uses will be found for polythene in the future and second, that the kind of research which led to its discovery will also lead to the discovery of many other useful new substances, for it has now been proved that the subjecting of suitable chemicals to very high pressures reveals hitherto unsuspected possibilities.

* Well-known British author and journalist specializing in scientific subjects. His books include "Science and Common Sense," "How Wireless Came" and "Inside the Atom."

Time and temperature control

(*Continued from page 143*) are merely as safeguards to the proper processing of the plastic article.

On a large multiple-platen press such as encountered in applications for the processing of laminates, it is quite often essential that operators on opposite sides of the press have a start button and signal light to provide safety in the starting operation. The function of the light is to indicate to the operator on one side that the operator on the other side of the press has loaded the press and depressed the momentary contact start button and is ready for the process cycle to commence. The two momentary contact start buttons are so arranged in an electrical circuit that the process cycle cannot be started until both the contact start buttons have been depressed.

Coordinated control

The term coordinated control designates a combination of several control elements into a single unified system designed to make process operations more completely automatic. A description of such a system involves the relationship of these functions and of the devices which are necessary to coordinate them.

Many of the previously described control features may be combined to provide a complete automatic control cycle. In most cases, the various control features can be easily combined one with the other without great difficulty. At times, however, the control problems become quite complicated, particularly where there are a large number of variables involved, and where interlocked circuits are required for maximum protection.

Figure 12 shows a typical coordinated control system. This system includes many of the previously mentioned features applicable to compression molding. The time cycle controller is the master instrument which serves to introduce the various process control functions at their appropriate time. The single duty bi-record temperature controller modulates the inlet steam valve to maintain a constant temperature to the platens. This controller also provides a record of the condensate temperature leaving the platens. The repeating cycle timer serves to discharge the accumulation of condensate at regular intervals.

The process cycle for the compression molding press is started by momentarily depressing the electrical start button. This causes air pressure to be applied to the dual diaphragm top on the two-pressure hydraulic valve. At the same time air pressure is locked on the diaphragm top of the drain valve to assure the closure of that valve. With the admission of hydraulic fluid to the ram cylinder, the lower platen of the press moves upward until it contacts the limit switch located on the press.

The purpose of the press limit switch is to determine the preheating position. It also serves to start the time cycle controller. The energizing of the limit switch permits the air pressure trapped on the dual diaphragm top of the two-pressure valve to be released to the atmosphere, closing the valve. The drain valve however remains closed. This effectively locks hydraulic pressure on the ram cylinder of the press so that the lower platen of the press remains in a fixed position.

Having started the time cycle controller from the operation of the limit switch, the timer functions to carry out the preheating period. It will be noted that preheating may be

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pre-selected by the manipulation of the three-way stopcock in the air line from the time cycle controller. Assuming that preheating is required, the stopcock would appear in the position shown on the drawing.

At the start of the process cycle, air pressure is also applied to the recording temperature controller and to the repeating cycle timer for the control of the platen temperature. With the application of air pressure the three-way valve in the condensate line is re-positioned so that the condensate must discharge through the condensate valve.

With the completion of the preheating period, air pressure is applied to the two-pressure hydraulic valve to cause the press to close. At the same time air pressure is relieved from the drain valve. The next step in the process cycle is the bumping operation. Again this feature may be pre-selected if required. As illustrated in the drawing, the stopcock is in the position which introduces the bumping feature.

The later portion of the process cycle is devoted to the cooling of the platens to permit the easy removal of the product from the mold cavity. When this period occurs, the temperature controller ceases to function because the timer cuts off the air supply to these instruments. At the same time the timer applies air pressure to the water valve which admits cooling water to the platens. The three-way valve in the condensate line is re-positioned as a result of the removal of air pressure from the temperature controller so that the cooling water will be permitted to travel to the water drain rather than to the condensate return.

At the completion of the process cycle the water valve closes and the press is opened by the push backs. The press travels downward until it contacts the knockout pins which are used to eject the product from the mold cavity. Obviously it is necessary for the lower platen to be raised so as to clear the knockout pins before the press is again ready for loading. This is accomplished by the inching button which is a push button operated type. Then the inching button functions to move the lower platen in the same manner as occurred prior to preheating. Should it be necessary to repeat the knockout operation, a three-way stopcock is provided to accomplish this feature. By manipulating the stopcock the lower platen of the press will again engage the knockout pins.

Automatic control of plastic molding presses by means of a controller in which process timing periods are readily adjustable and by means of which both pneumatic and electrical controls are provided, is readily adapted to plastic molding presses.

Automatic control insures a uniform quality of product by providing accurate time and temperature control in accordance with a pre-determined schedule. It relieves the operator of worry and responsibility by providing interlocks to safeguard press operation. It also relieves the operator of the necessity of operating control valves. Hence more of his time is available for supervision.

Cellulose propionate plastic

(*Continued from page 119*) which all have the same minimum molding temperature. These compounds were all molded with the same injection machine and die, using the same cycle, the same die temperature and the same differential in temperature between the front and back heater. The minimum molding temperature listed is the lowest front

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heater temperature at which full shots could be consistently obtained on steady cycle. Commercial molding temperatures would be 35 to 50° F. above the figures given. It is seen from Table II that a cellulose propionate composition of 323 F. A.S.T.M. flow temperature has the same minimum molding temperature as a cellulose acetate butyrate compound of 19° F. softer flow. These laboratory data have been substantiated in the commercial molding of cellulose propionate.

Experience in the laboratory and plant

It has been demonstrated in both laboratory and trade molding that the surface finish of injection-molded cellulose propionate parts is free from the smudge and cloud that frequently necessitate additional finishing operations on parts molded from other cellulosic plastics. This is a worth-while cost saving to the molder. Another peculiarity which works to the advantage of the molder is the wide range of molding temperature over which satisfactory pieces can be made. This property has been observed through all the laboratory molding, and was confirmed in commercial molding, where, in one instance, good parts were obtained over a temperature range of 80° F., compared with the normal span of 30 to 50° F. for other cellulose ester plastics. Ability to injection mold satisfactorily with small gates and to degate without breaking back into the molding or tearing up skin has also been demonstrated consistently. In all except the very hardest compositions there is no trace of skin or lamination, a point which is of distinct value in uses such as toothbrush handles, where high-speed drilling is performed on the finished part.

Characteristics of cellulose propionate

Cellulose propionate has excellent flow characteristics under injection-molding conditions. Apparently, it softens more suddenly at molding temperature than does cellulose acetate, and flows more easily. This is indicated by its ability to fill dies through small gates, and may also be the explanation of its excellent welding properties. In all tests to date, both in laboratory and trade molding, the cellulose propionate parts have shown less evidence of a weld line than any other cellulosic plastic molded in the same part. Tests, both in impact and tension, have also shown the strength of the weld to be superior.

The good flow and set-up speed of cellulose propionate also result in very satisfactory injection cycles. In running it in a variety of dies, in comparison with all the cellulosic plastics and polystyrene, its molding cycle has, in each instance, been as fast as any of these plastics. In one instance, Forticel has substantially bettered the best cycle that could be run with cellulose acetate, running a 20-cavity toothbrush handle die in less than 30 seconds where a 42-second cycle was required for cellulose acetate.

Sheets and films

Although most of the development work to date has been concentrated on molding material, and the data discussed here have had reference to molding material, preliminary studies have also been completed on plastic sheets and film made from cellulose propionate. These investigations indicate that this film and sheet material will have advantages in flatness, dimensional stability and toughness, and will be a distinct addition to the plastics now available in film and sheet form.

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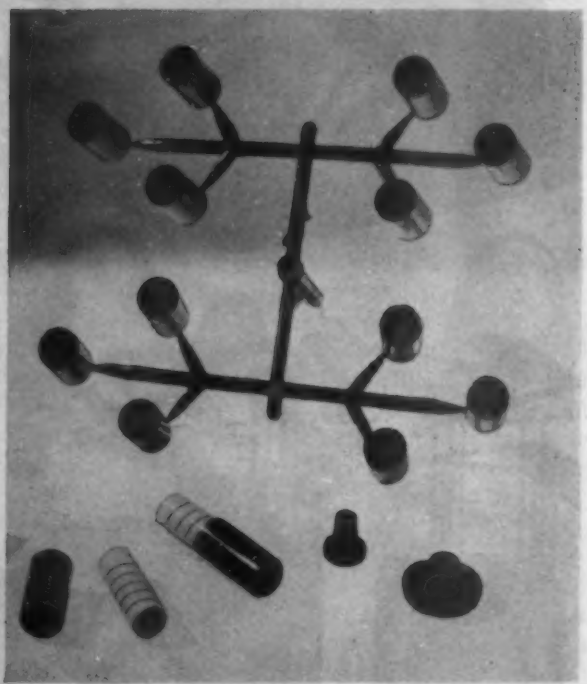

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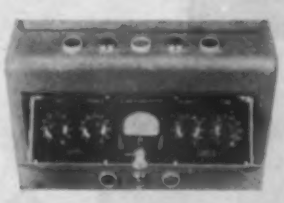

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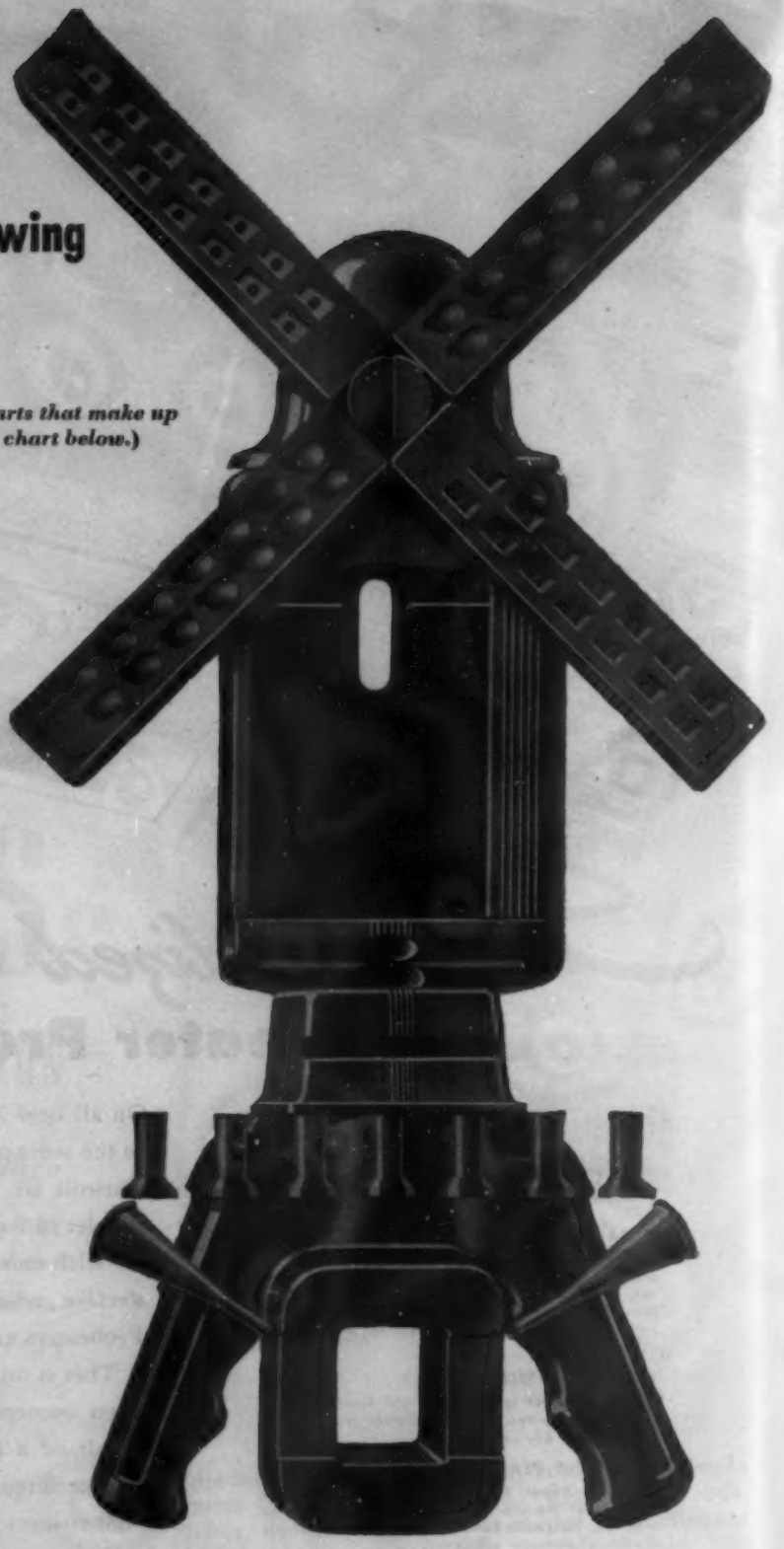

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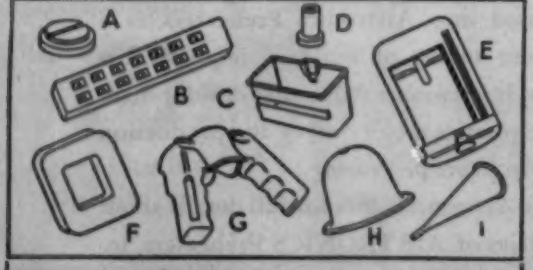

(A) Brush cap for motor—compression; (B) Terminal block—compression; (C) Aircraft toilet paper holder—injection; (D) Bushing—compression; (E) Billing machine housing—compression; (F) Coil form—compression; (G) Gunner's handles—compression; (H) Coil housing—compression; (I) Funnel—compression.

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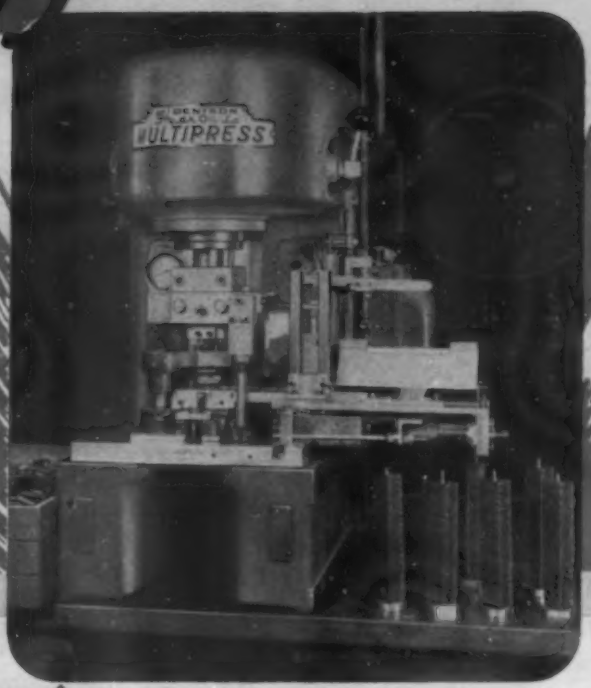

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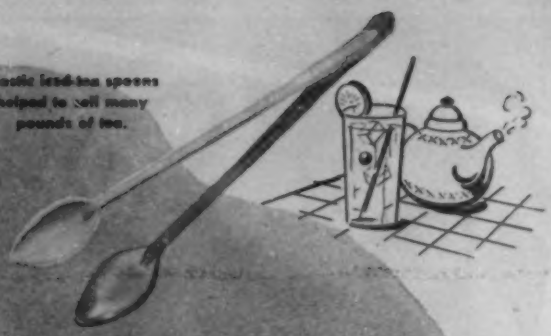

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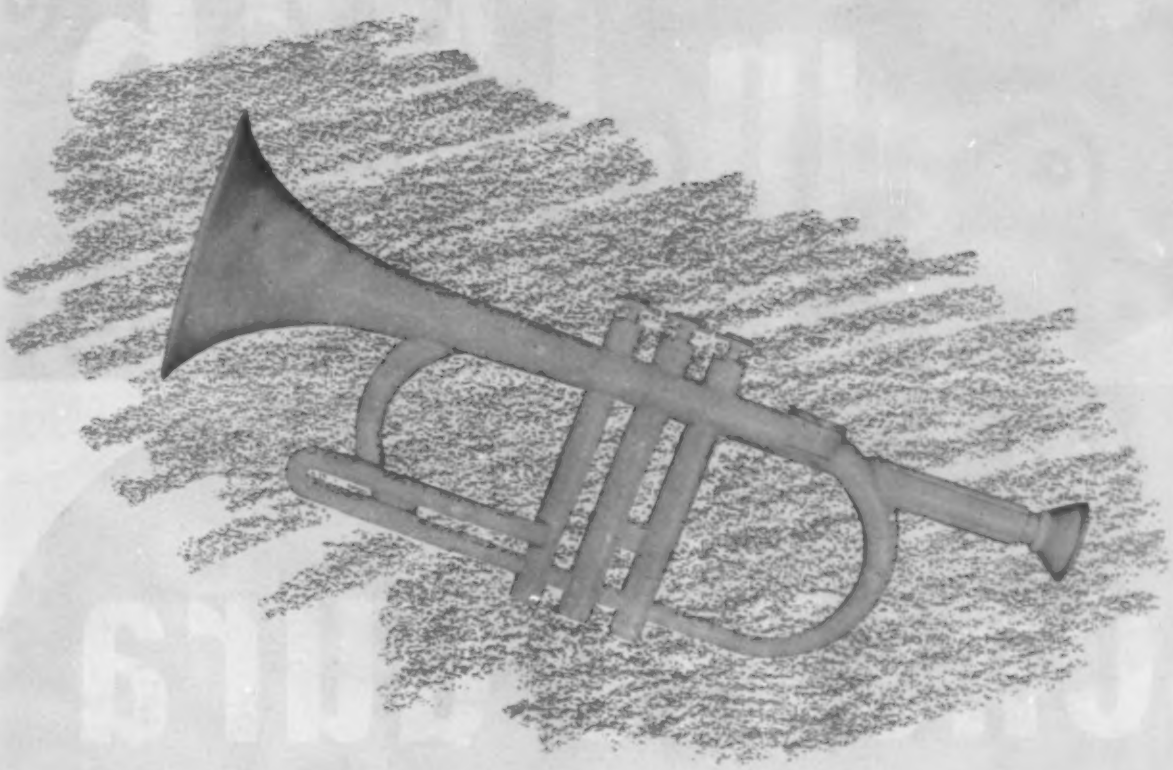

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KIMPREG adds the following advantages to plywood: 1) increases durability and flexural strength; 2) provides resistance to moisture and vapor; 3) armor-plates against extreme abrasion; 4) diminishes grain-raising effects; 5) makes the material scuffproof, splinterproof, snag-resistant; 6) affords a stainproof, washable, "wipe clean" surface; 7) creates resistance to chemical action, decay, temperature-extremes, fire, vermin, and mold. Moreover, it is warm to the touch, does not have the chill "feel" of metal surfaces.

Used for airborne "pre-fab" huts, glass-smooth tables for packing parachutes, water-proof ammunition boxes and scores of other uses, KIMPREG has distinguished itself on the vigorous proving-ground of wartime. Soon it will be offered in a variety of appealing hues.

Now is the time to investigate the possibilities of KIMPREG-surfaced materials for your *peacetime* requirements.

Write us for further information and names of those plywood manufacturers who are currently using KIMPREG plastic surfacing material.

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Send Coupon for FREE KIMPREG Book to: Kimberly-Clark Corporation, Neenah, Wisconsin

MP1245

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A PRODUCT OF Kimberly Clark RESEARCH

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Get a unit that'll "take it"

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*Get a Thermex**

WHEN you invest in high frequency heat, make sure of full benefits from this electronic technique of heating plastics material for molding. Get a dependable high frequency heating unit. Get a Thermex Red Head.

Thermex ability to "take it" has been a matter of record for years. Thermex was the first practicable industrial high frequency dielectric heating equipment put on the market. The first Thermex units installed are still going strong. Built by the organization that has been specializing in dielectric heating equipment since the beginning, the Thermex Red Heads of today are bound to be more efficient and dependable than ever.

If you are converting or expanding your molding facilities, if you are building a new plant, find out about Thermex Red Heads. They constitute the most complete line of high frequency heating units for the plastics industry. Mail the coupon or contact Girdler branch offices at 150 Broadway, New York 7; 228 N. LaSalle Street, Chicago 1; 1836 Euclid Avenue, Cleveland 15.

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Please send complete information about Thermex.

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Speeding Laminate Production

PLYOPHEN

in Scores of Industries

A few of the fast curing Phenolic Resins and Varnishes from the World's Largest Producer of Synthetic Resins

P-398 — For exterior plywood. Requires no catalyst...wood failure is exceptionally high...cures rapidly at moderate temperatures...requires only 75 to 250 pounds pressure psi.

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No. 5031 — Cresol base punching stock varnish, producing, with paper, laminates of the very best dielectric strength. Cures at 70 to 80 pounds steam pressure on platens. Hot punches especially well.

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No. 5022 — Exceptional curing speed—as rapid as 3 minutes with sheets .16 of an inch thick. Produces odorless laminates with excellent water resistance and mechanical properties and can be used for low or high pressure laminating.

SPECIAL NOTE

RCI is also headquarters for surface-coating resins including: Super-Beckacites for highest grade spar varnishes . . . Beckacites for architectural varnishes and enamels . . . Beckasols for all types of industrial and architectural finishes . . . Beckamines for imparting hardness to baked finishes.

RCI also supplies Beckamines for developing wet-strength in papers as well as for water- and weather-resistance in fibre-board adhesives. Plyamines for plywood are another important RCI product.

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RIGHT ANGLE LOADING

Plus staggered rollers that will not "TRACK"...

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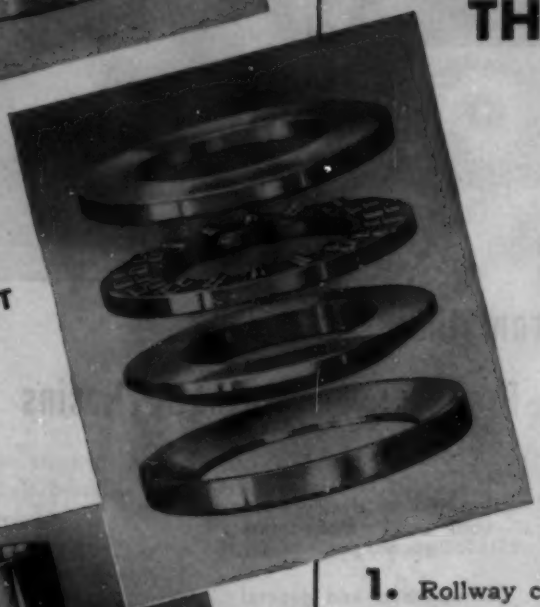

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Solid-cylindrical-roller THRUST BEARINGS

When thrust loads are heavy . . . when maximum bearing capacity in minimum space is required . . . when the aim is to design "preventive maintenance" into the mechanism itself . . . Rollway solid cylindrical roller Thrust Bearings offer sound solutions to the basic problems. Here are the reasons why:

1. Rollway carries all loads at right angles to the roller axes.

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3. Thrust plates, held to extremely close limits of parallelism, afford a linear contact with the straight cylindrical rollers, doing away with Brinell effect and roller "pinch outs" with its consequent roller-end wear and rubbing friction.

Six basic types in many sizes to choose from. Send a print or detailed description for free bearing recommendation.

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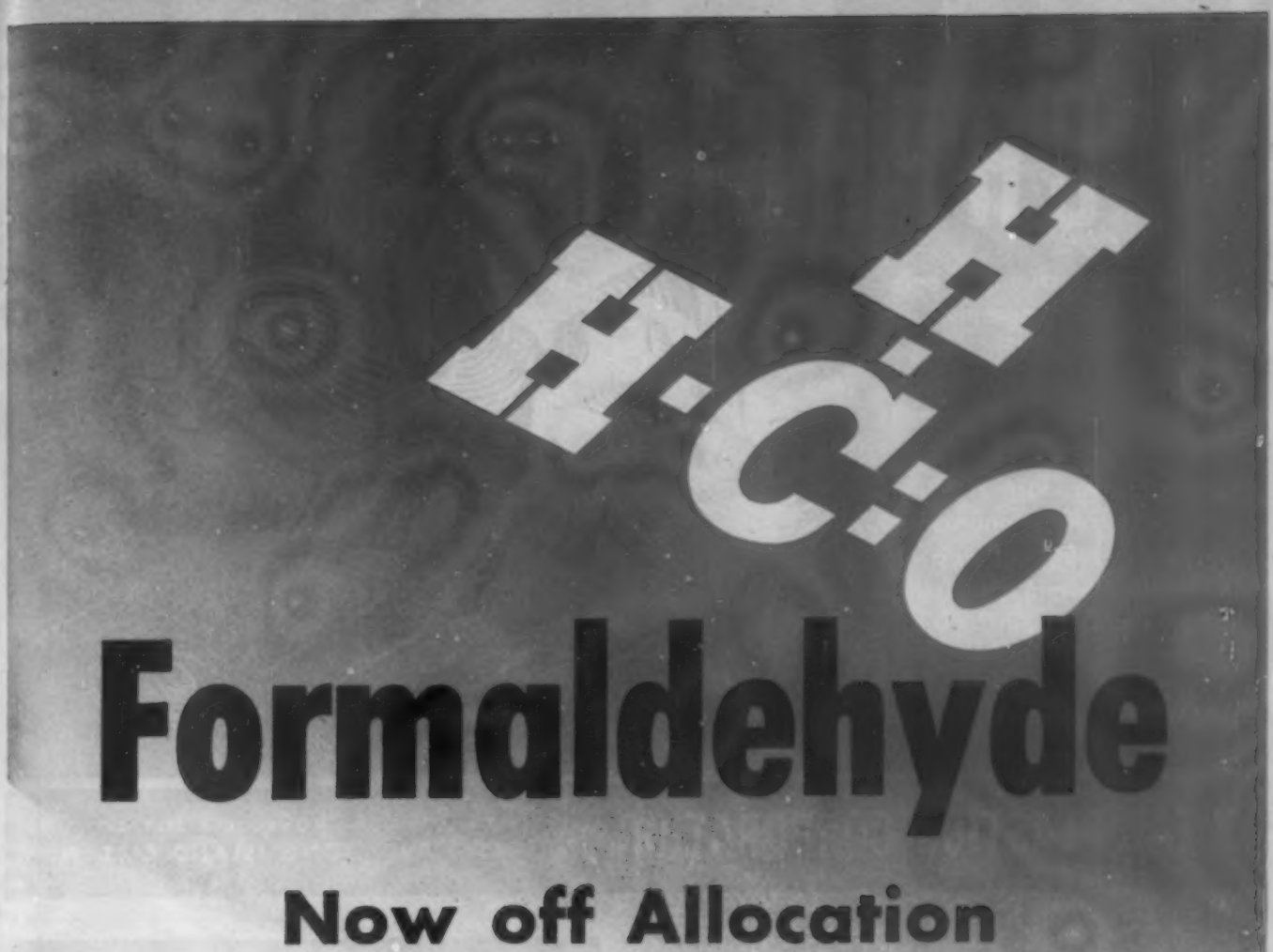

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** New York Metropolitan District only*

Heyden 37% Formaldehyde U. S. P. solution is characterized by uniform strength and high purity. Of special interest to all resin and plastic manufacturers are the low acidity and metals content.

For over thirty years Heyden Formaldehyde has been a standard of dependability. Rigid laboratory control assures you of a uniform raw material.

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Also specify Heyden for Paraformaldehyde and Hexamethylenetetramine.

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CAPACITY

Plastic manufacturing is entering a highly competitive era; economical operation is impossible without large scale production — tens of thousands, millions of units —

Capacity of production takes its place with creative imagination and engineering skill as a vital factor in the making of Ideal plastic items!

IDEAL PLASTICS CORPORATION A DIVISION OF IDEAL NOVELTY & TOY CO., INC. 23-10 43rd AVE., LONG ISLAND CITY, N. Y.

Looking Backward then FORWARD!

This year, more than any other, we are happy to send you Seasons' Greetings. And too, you have been tolerant, Mr. Dealer . . . tolerant to the extreme when we have been unable to satisfy your needs for the Gits line of molded plastic products. For this we thank you . . . sincerely.

Wrapped up with these greetings is our promise to supply you (through the dependable jobbers) with the biggest line of lustrously colored, utility plastic items on the market—in '46. Again, Mr. Dealer, thank you for your patience.

GITS *Molding Corporation*

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Manufacturers of the Famous Gits Flashlights, Knives, Savings Banks, Games, Protect-o-shield, etc.

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UNIQUE *Material Processing Equipment*

Attrition Mills

Crushers, Grinders, Sifters, Attrition Mills . . . Material Processing Machinery of every type. Designed to your requirements by experienced engineers whose reputation is founded upon doing things right. Inquiries invited!

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TEAMING UP WITH CHEMACO PLASTICS—

Chemaco Cellulose Acetate
and
Chemaco Polystyrene
FOR LIPSTICK CASES

Lipstick for Harriet Hubbard Ayer by Harry Broder

Two CHEMACO plastics were chosen to create this handsome lipstick case for Harriet Hubbard Ayer—CHEMACO Cellulose Acetate and CHEMACO Polystyrene. There were sound reasons for each choice. CHEMACO Cellulose Acetate was selected for the outer and inner cases because it provides a durable, lustrous, long-lasting housing in warm-to-the-touch translucent shell pink. The inner case and elevator in clear crystal are molded from CHEMACO Polystyrene because it is unaffected by the ingredients of the lipstick or other cosmetics. From this happy combination of plastics, correctly specified, has evolved a lipstick case *in mass production* that is beautiful and practical, and will open and close, elevate and lower without sticking. Perhaps your product needs a new engineering approach and a new beauty. CHEMACO engineers can help you.

CHEMACO produces four thermoplastics, Cellulose Acetate, Ethyl Cellulose, Polystyrene, and Vinyl Compounds.

Send for the new CHEMACO Booklet of Plastics. Department H, Chemaco Corporation, Berkeley Heights, N. J.

Chemaco Corporation

A subsidiary of Manufacturers Chemical Corporation

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WE BUY, SELL, PROCESS

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25 years experience in designing and building molds for leading molders.

Our plant is modern in equipment for producing the best in molds. Compression, Injection, Transfer.

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Known thruout the Plastics Industry by its Characteristic Design

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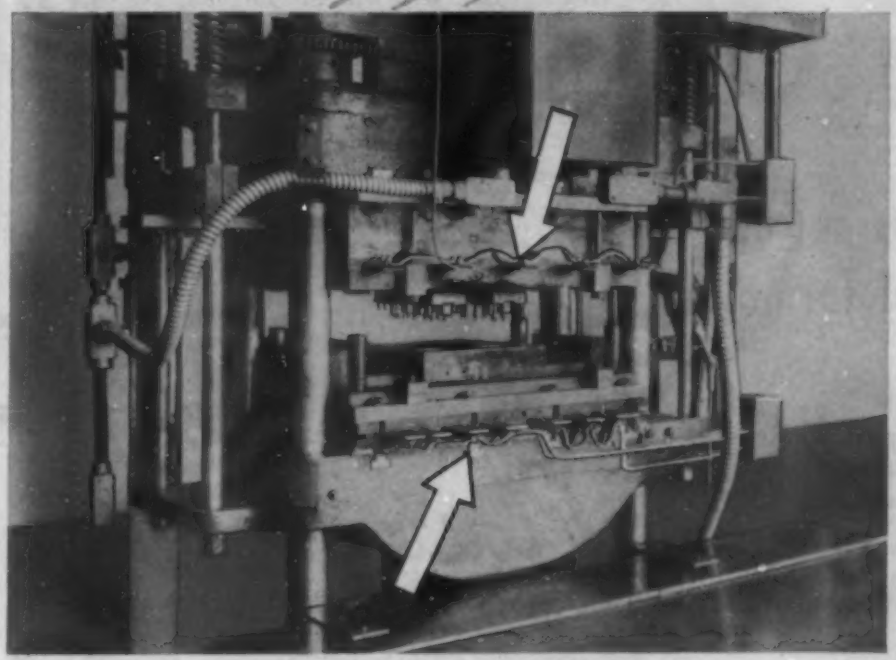

CHROMALOX EQUIPPED PLASTIC MOLDING PRESS
The fast, clean heat in this 100 ton extrusion press costs only 8.5¢ per hour and is thermostatically controlled to desired temperatures.

Keener competition demands more efficiency in operation!

Versatile HEAT—You can apply a CHROMALOX *Electric* Heating Unit or a CHROMALOX Engineered Application wherever you need or use on-the-spot heat for *space, gases, metals* or *liquids.*

Controlled HEAT—You get more uniformity of product or process. Exact temperature—to 1000°F—as required by the application, can be easily regulated and maintained—day in and day out—by thermostat or switch.

Economical HEAT—Installation and maintenance costs are low. You put all of the heat right where you need it when you need it. You save in other ways too. Get the facts.

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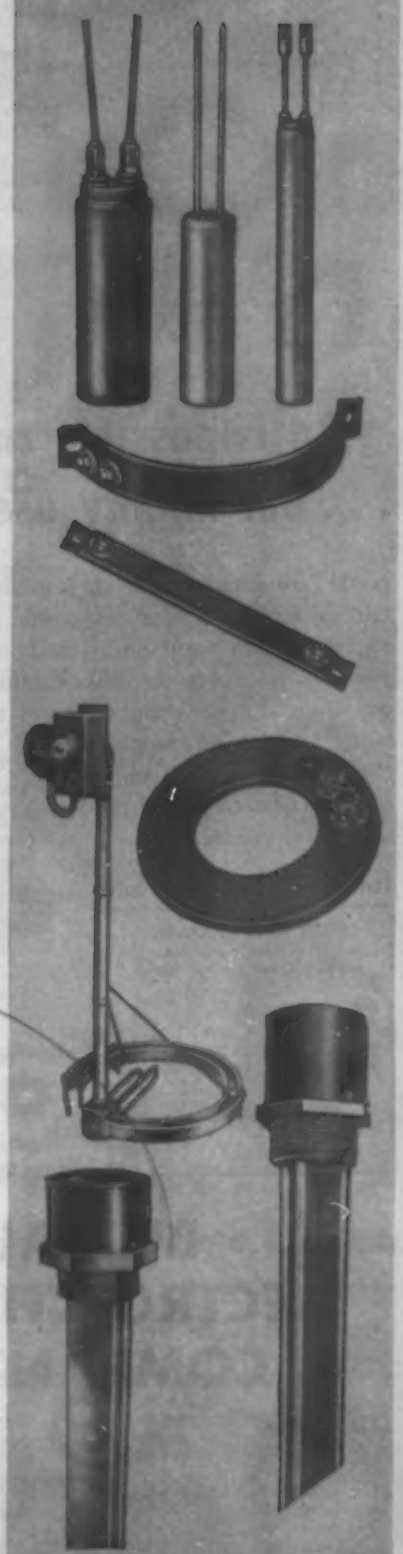
Electric Heating at its Best!

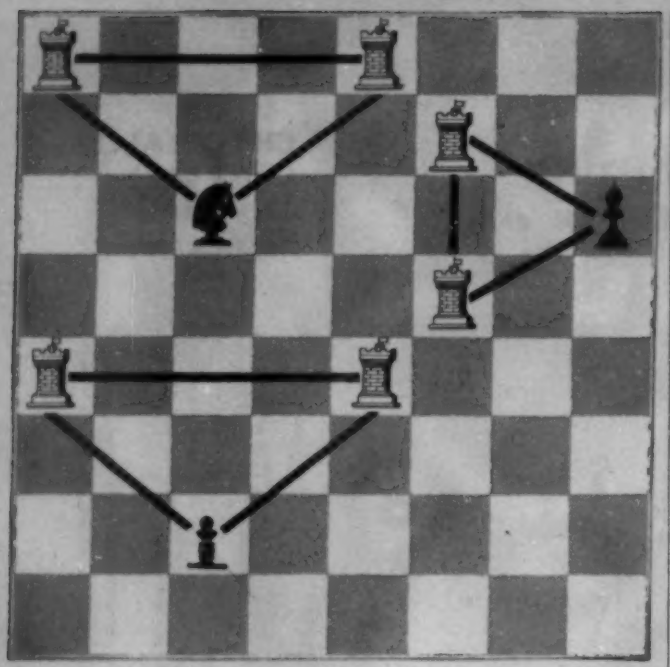
Need More Information?

Write for "100 Ways to Apply Electric Heat" Booklet, Catalog 42 and address of CHROMALOX Application Engineer serving you.

IC-11

CHROMALOX
Electric
HEATERS





An impossible chess set-up . . . but mighty useful formulas

Metal Peroxides by Becco are insoluble in water but soluble in mineral acids They are compatible with many inorganic and organic materials and can be used in the preparation of tooth powders, in processing of foodstuffs, and, in general, where oxidation at high temperatures is required. Some of these peroxides also find use as chemo-therapeutical agents and for cosmetic and pharmaceutical preparations.

ACTIVE OXYGEN IS ON ACTIVE DUTY

OTHER BECCO PRODUCTS:
Electrolytic Hydrogen Peroxide —100 vol (27.5% by weight)
Ammonium Persulfate
Potassium Persulfate
Pyrophosphate Peroxide*
Sodium Carbonate Peroxide*
Acetyl Peroxide*
Urea Peroxide
*Available in research quantities only at present.

BECCO MAGNESIUM PEROXIDE—50%
White Powder.
Contains 14.2% active oxygen.
Exceedingly stable even at temperatures above 100° C.

BECCO CALCIUM PEROXIDE—60%
Yellowish powder.
Contains 13.6% active oxygen.
Has outstanding stability even above 100° C.

BECCO ZINC PEROXIDE—45%
White powder.
Contains 7.4% active oxygen.
Extremely stable even at 100° C.

The available supply of all three of these Metal Peroxides is limited at present.

BUFFALO ELECTRO-CHEMICAL COMPANY, INC.

BECCO
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FOOT POWERED SHEAR CUTS COSTS

Famco FOOT POWERED Squaring Shears cut up to 18 gauge mild steel with ease. Made in five sizes . . . 22", 30", 36", 42" and 52" cutting widths (three largest have "hold down" attachment). The knives of all models have tool steel cutting edges. Compression springs are encased against breakage. Furnished with front, side and back gauges. Write today for full information on the Famco line of low cost Squaring Shears.

POWERFUL PRESSES THAT NEED NO POWER

Famco Foot Presses, made in 10 models (bench and floor stand types) are widely popular for light forming and stamping operations.

Famco Arbor Presses deliver up to 15 tons pressure without power cost. Make assembly or dismantling easy. 32 models, in bench or floor types.

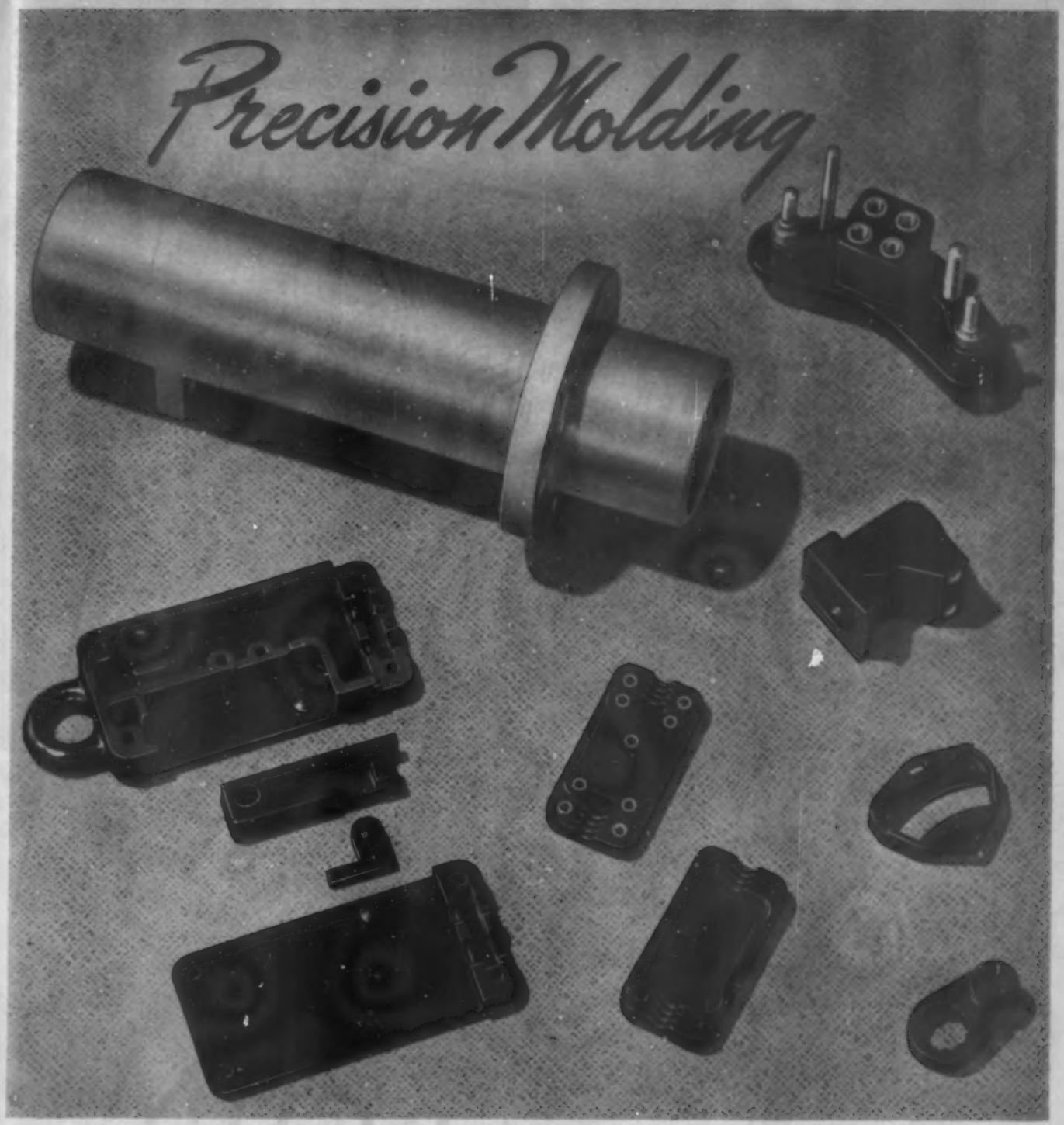
FAMCO MACHINE COMPANY, 1305 18th STREET, RACINE, WISCONSIN

famco ARBOR PRESSES
FOOT PRESSES
SQUARING SHEARS

Plastic Marking

IN GOLD, SILVER OR COLORS

Small Designs, Trade Marks, Names, etc.
Clean-cut precision markings on plastic parts at production speeds up to 1,000 per hour, using unskilled operators. Send samples and details of your stamping problems.
Kingsley GOLD STAMPING MACHINE CO.
★ HOLLYWOOD, CALIFORNIA ★



☆ For Mass Production Products ☆

The photo above illustrates merely a few of many shapes and sizes of plastic parts we mold in large and small quantities for all kinds of applications.

We also have mold building facilities at your disposal if desired and we invite your correspondence whatever the nature of your requirements may be.

INTERNATIONAL MOLDED PLASTICS, INC.

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VARCUM PHENOL CH_2O RESINS

NOW! You Can Make BOTTLE-CAP LINERS from Waste Gasket Material

NEW ODORLESS, NON TOXIC RESIN IS PERFECT CORK BINDER

At last we've found a resin binder for cork composition that will enable you to salvage gasket cutouts and convert them into additional profits as cork liners for bottle caps. This new phenolic resin binder is Varcum 2954 and fully meets Federal Specification H.H.-C-576 which prohibits the use of animal glue as binders in cork compositions.

Varcum 2954 binder is supplied ready to mix with ground cork in a viscosity range of 1500-2200 centipoises and can also be used by manufacturers of extruded cork rods for bottle cap liners.

Remember, Varcum 2954 assures you of cap liners with no taste, no odor, no mildew or toxicity.

Want Samples?

Better let us send you a working sample of Varcum 2954. Just drop us a line on your company letterhead.

VARCUM

CHEMICAL CORPORATION

NIAGARA FALLS, NEW YORK

SARAN by NATIONAL

A TOUGH THREAD FOR NEW WEAR-RESISTING FABRICS

This sturdy filament is creating fabrics of exceptional durability and beauty in a wide range of applications. It is highly resistant to dirt, grease and acids . . . . to scuffing and abrasion. Extruded as a monofilament or rattan, SARAN is supplied to mills, braiders and other fabricators. Write us and learn what SARAN can do for your product.

NATIONAL PLASTIC PRODUCTS Company

ODENTON, MARYLAND

PLASTIC MOLDING . . . *and more!*

Profit by Maico's experience, equipment, complete service!

Injection and compression molding—fabrication—assembly—tool and die making—authoritative engineering counsel . . . all these are available from Maico.

EXPERIENCE? For many years we've been producing plastic parts for our medical electronic instruments. During the war we branched out into many other fields and today we are manufacturing a wide range of plastic items.

Consult us on your plastic plans and problems! Our facilities are at *your* service.

MAICO CO., Inc.

Dept. 55B

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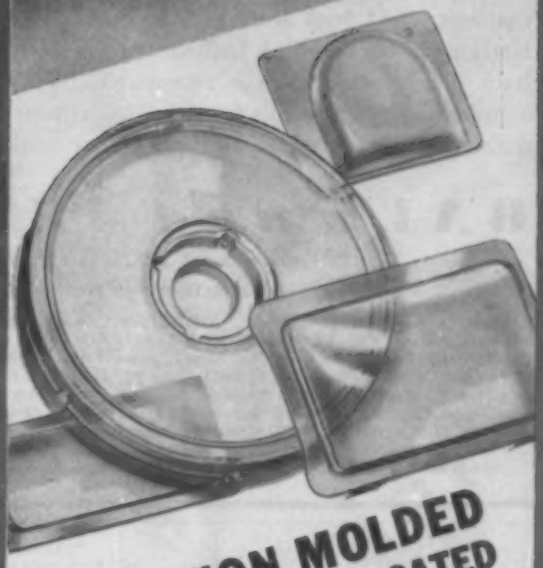
FROM BLUEPRINT TO PRODUCT IN PLASTICS BY FELSENTHAL . . . FROM BLUEPRINT TO PRODUCT IN PLASTICS BY FELSENTHAL

PLASTIC CRYSTALS . . . BY FELSENTHAL



INJECTION MOLDED LAMINATED - FABRICATED

Crystal clear windows to protect dial pointers on radios, automobile dashboards, meters, clocks, communications equipment and similar apparatus. All sizes. Delicate discs to thick-walled units. Non-inflammable. Unbreakable.

No matter what your "window" problem, Felsenthal's Design and Engineering Department is at your service, and not only for crystals but for a multitude of other important purposes. Our new catalog shows hundreds of products in plastics—ask for No. 3-A.

SARAN NAVY

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G. FELSENTHAL & SONS

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BRANCH OFFICES: NEW YORK • DETROIT

Est. 1899

LEADING SCRAP GRINDER IN ADVANCE MOLDING CORP. PLANT

Advance Molding Corp., of New York like many leading molders, relies exclusively on Ball & Jewell equipment to perform important scrap grinding function. Model shown in photograph is #1½ with Texrope drive. This compact machine handles a maximum amount of scrap in a minimum amount of floor space.

Like other Ball & Jewell machines, this one has extra heavy castings, solid tool steel knives, outboard sealed S.K.F. ball bearings. The special baffled hopper prevents waste or fly back of material. Bin is removable. The entire machine is simple in design to allow for quick take down and cleaning when different colors or different types of materials are run.

This is #12 of a series of advertisements showing typical Ball & Jewell scrap grinder installations in the plastics industry.

BALL *and* JEWELL

20 Franklin Street, BROOKLYN, N. Y.

Since 1895, Manufacturers of Patent Rotary Cutters

CHICAGO: Neff, Kohlbusch & Bissell. DETROIT: J. C. Austerberry's Sons. LOS ANGELES: Moore Machinery Co. LOS ANGELES & SAN FRANCISCO: Machinery Sales Co. NEW ENGLAND: Standard Tool Co., Leominster, Mass. ATLANTA, GA.: George L. Berry. ST. LOUIS: Lanmore Sales Co. CLEVELAND 22, OHIO: L. F. Willmott 37 Latimore Rd., SEATTLE 4, WASHINGTON: Olympic Supply Co. KANSAS CITY, KANS.: Fluid Air Engineering Co. AUSTRALIA and NEW ZEALAND: Scott & Holladay Pty., Ltd., SYDNEY, STOCKHOLM, SWEDEN: Ingenjorsfirman Teknova. CANADA: Williams & Wilson, Ltd., Toronto & Montreal.

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"It's a Honey!"

That's the way one plastics plant executive expressed himself when asked about the operation of his

ATLAS Type "E"
High Pressure Reducing Valve

You, too, will become enthusiastic about this outstanding valve if you are now having trouble with high pressure reductions and will give Type "E" a trial. It reduces pressures up to 6000 lb. per sq. in. without shock—oil, water, or air.

Why? Why? Why?

That's what nearly everybody asks. Type "E" is so superior because every detail is modern to the last atom. The entire body, for instance, is of forged steel. The internal metal parts are entirely of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure.

Ask for complete information.

For other ATLAS plastics plant products see the partial list in our ad in the January 1945 issue of MODERN PLASTICS

ATLAS VALVE COMPANY

REGULATING VALVES FOR EVERY SERVICE

277 South Street, Newark 5, N. J.

Representatives in principal Cities

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WC INC 1812

Let us tell you about our unusual service to manufacturers requiring small sheet metal parts.

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METAL PARTS

Eyelets
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WATERBURY COMPANIES, INC.

FORMERLY WATERBURY BUTTON CO., EST. 1812

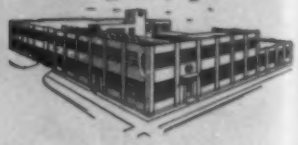
DEPT. B, WATERBURY, CONN.

IT'S NEW
WEIGHS ONLY 4.4 POUNDS
IT'S ONLY 3⅞ INCHES LONG EXCLUDING DRIVE SHAFT
BUT IT DELIVERS PRESSURES UP TO 1500 P.S.I.
CAPACITIES: 3.5 g.p.m. at 1,500 r.p.m. or 7 g.p.m. at 3,000 r.p.m. Triangular mounting (shown), SAE magneto mounting flange or special mountings.
Pesco GENERAL PURPOSE HYDRAULIC PUMP

It's tiny, but packed with power . . . this NEW General Purpose Hydraulic Pump by PESCO. It fits the palm of your hand with ease . . . yet it develops pressures up to 1,500 p.s.i. Superior design gives this pump unusually high volumetric efficiencies—95% and better at 3,000 r.p.m. at 1,500 p.s.i. And, small as it is, it features *Pressure Loading*, the exclusive PESCO development that *automatically* maintains minimum clearance between pump gears and gear housing, making possible continuous high operating efficiencies over a wide range of temperature variations and speeds.

The possible uses of this NEW PESCO General Purpose Hydraulic Pump cover numerous industrial applications. Its sturdy, yet simple construction assures a long life of trouble-free operation. Other models available for pressures up to 3,000 p.s.i. Write for Bulletin No. 101 and other descriptive literature on hydraulic pumps. PESCO Products Co. (division Borg-Warner), 11610 Euclid Avenue, Cleveland 6, Ohio.

Your Choice Now AFFECTS THE FUTURE



Nosco's Modern Plant is better equipped to serve you.

WRITE . . . TODAY
GIVING YOUR REQUIREMENTS

Choosing a molder for your plastic products is mighty important. Molded Plastics may look alike but there's a difference. The right choice of a molder Now will effect your future.

There is a freshness about Nosco well molded plastics that sets them apart. In a modern plant devoted to Plastics, our creators, designers, and engineers working with fine equipment turn out plastic parts with *Distinction.*

With a knowledge of plastics that sometimes lets us accomplish the unusual, Nosco standards for Quality Molding give each plastic piece the freshness that's different.

For Planned Plastics Know Nosco Now!

NOSCO Plastics

DIVISION OF
NATIONAL ORGAN SUPPLY CO. • ERIE, PA.

Service with a punch!

● Allied's R-B Interchangeable Punch and Die is "standard" in metal working and plastic industries. Standard shapes and sizes carried in stock. Illustrated are four of the thousands of specially-designed punches we have made. Special R-B punches and dies made in any material, shape or size desired. Send for large, illustrated R-B catalog, now.

ALLIED PRODUCTS CORPORATION

Pearl Essence

Special types have been developed for use with

Cellulose Esters (Acetate, Butyrate)
Cellulose Ethers (Ethyl Cellulose)
Vinylites (All types)
Acrylates (Lucite, Plexiglas)
Polystyrenes

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MEARLMAID PEARL ESSENCE

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MEANS DIAL PRECISION

Union have manufactured complete mechanically engraved precision dials of Plexiglas, steel aluminum and brass, luminous or fluorescent treated.

Their 15 years of manufacturing experience is your guide to unfailing accuracy.

Discuss your dial problem with Union — address Union Tool, 191-A Pine Street, Providence, R. I.

UNION TOOL CO.
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CATALYSTS FOR POLYMERIZATIONS
DRYING ACCELERATORS · OXIDATION AGENTS · BLEACHING AGENTS

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Special Organic Peroxides

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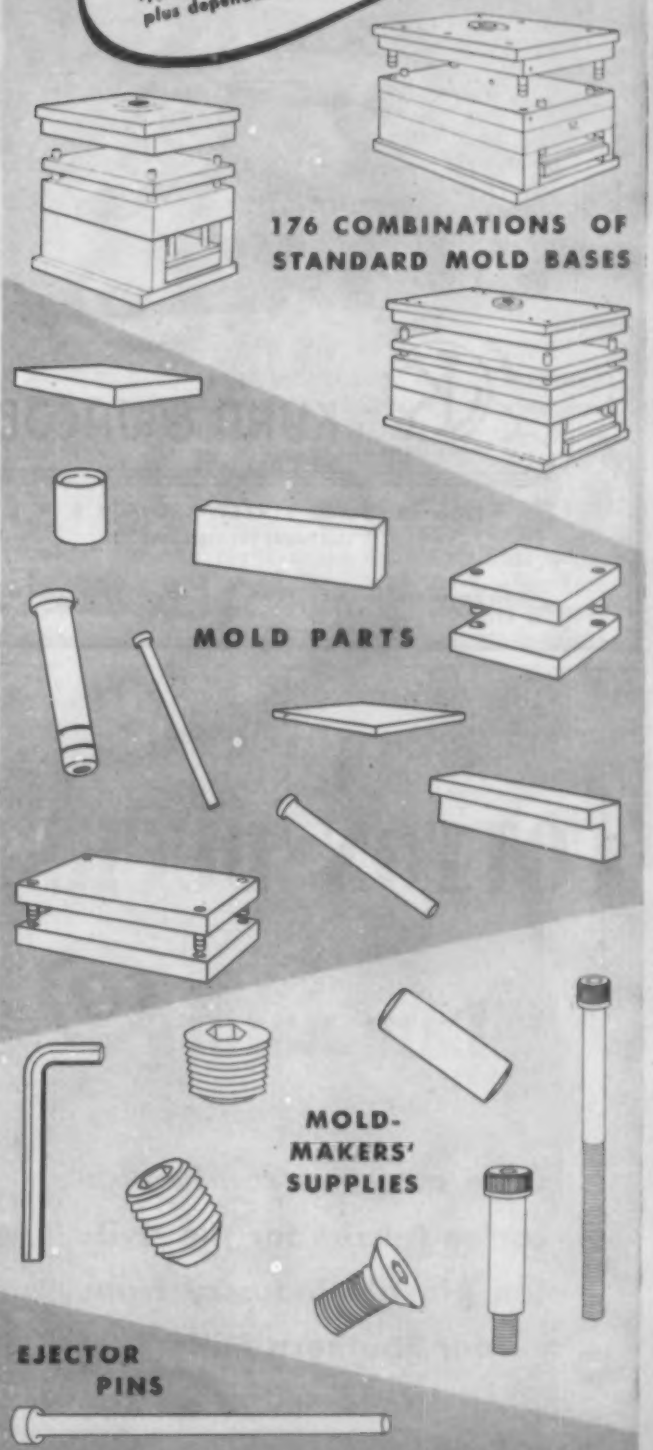
LUCIDOL CORPORATION
BUFFALO (5) N. Y.

DEPENDABLE SUPPLIES for MOLD-MAKERS

At DME — mold-maker's headquarters — are all types of standard and stripper plate mold bases plus dependable standard parts.



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MOLD PARTS

MOLD-MAKERS' SUPPLIES

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Exterior of Infra-Red Conveyor Belt Tunnel for removing moisture from plastic material prior to molding.

Sides dropped to show arrangement of Infra-Red light bank and materials passing under light conveyor belt.

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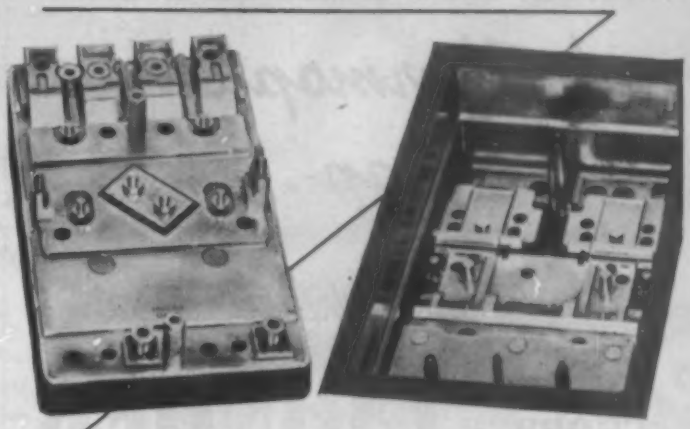
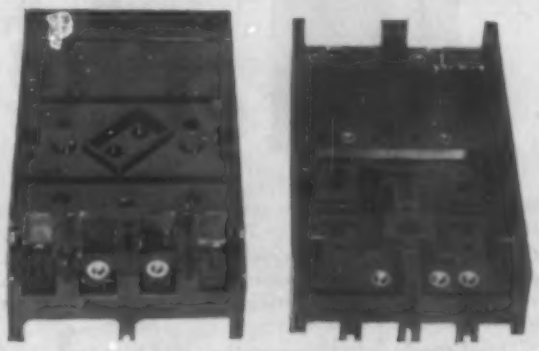
BACKED BY THE RIGHT MOLD STEEL



A lot of hours went into the making of this mold and force for a plastic circuit breaker case. And it was an intricate job! Metal inserts, holes, sections, ribs and cut-outs were *molded-in*.

To back up that mold design and the hours that went into mold making, to keep unit costs down, called for the right mold steel. So Carpenter *Samson No. 2* Mold Steel was used—because it provides high strength combined with easy machining, and because it gives flawless finishes.

When you have a tough mold making problem, or when you want to get better results on *any* job, call your nearby Carpenter representative. Put his mold steel experience to work on your molding problems. And if you don't already have a copy, ask for the 36-page book, "Tooling Up for Plastics."



Plastic circuit breaker cases molded for The Trumbull Electric Mfg. Co. by The Watertown Mfg. Co. Molds made of Carpenter *Samson No. 2* Mold Steel by Royal Tool Company.

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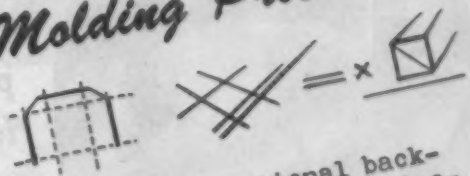

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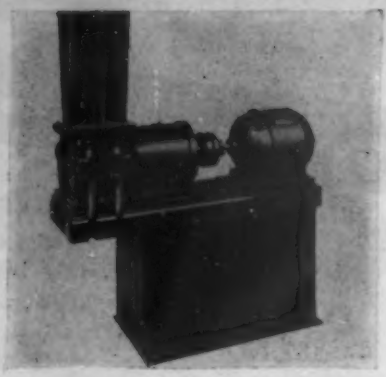

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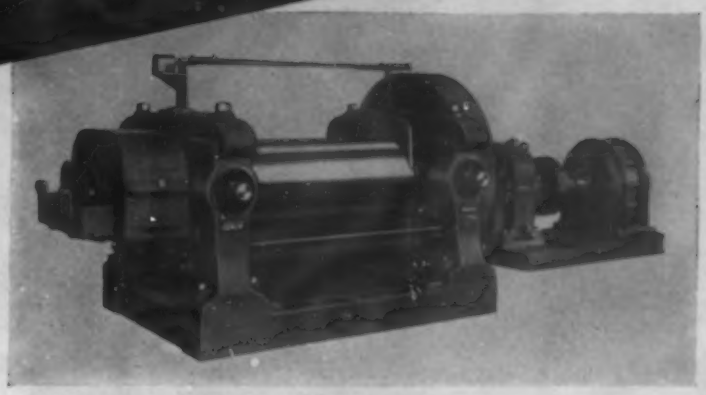

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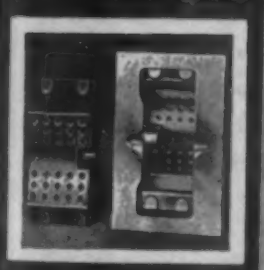

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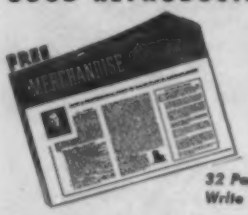

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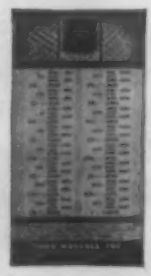

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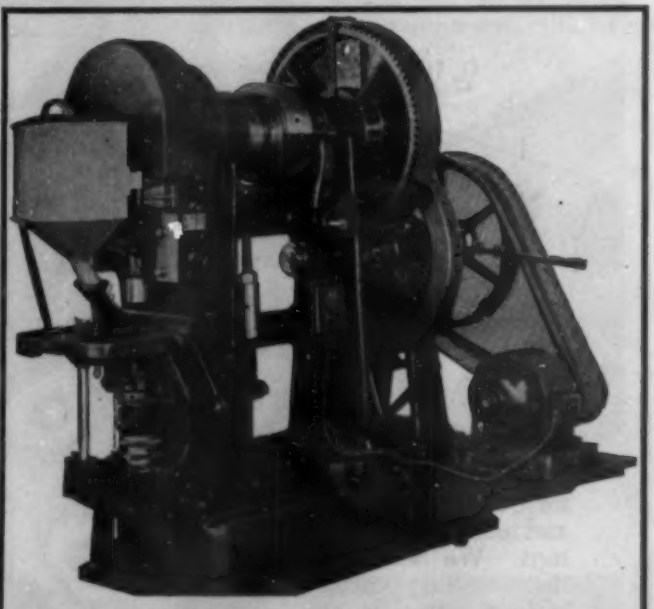

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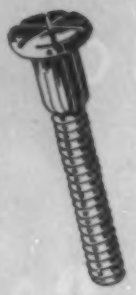

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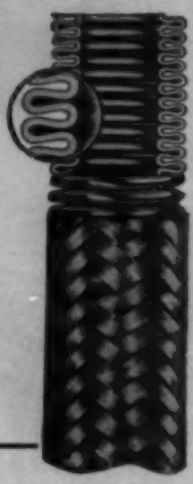

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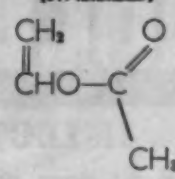

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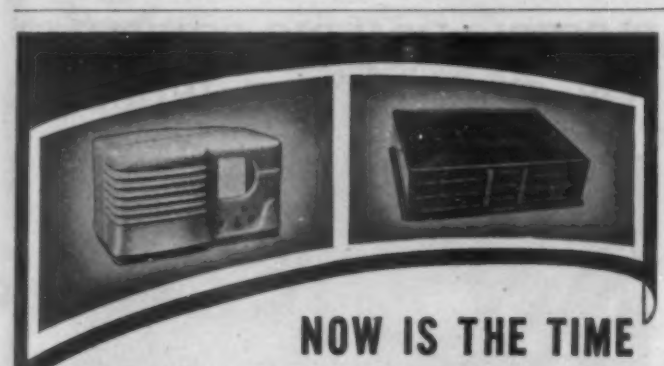

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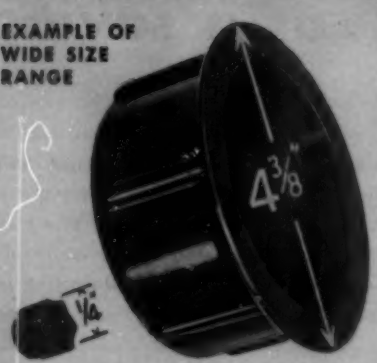

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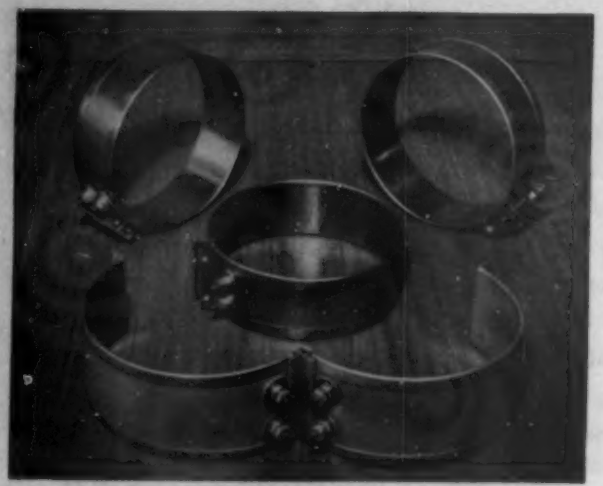

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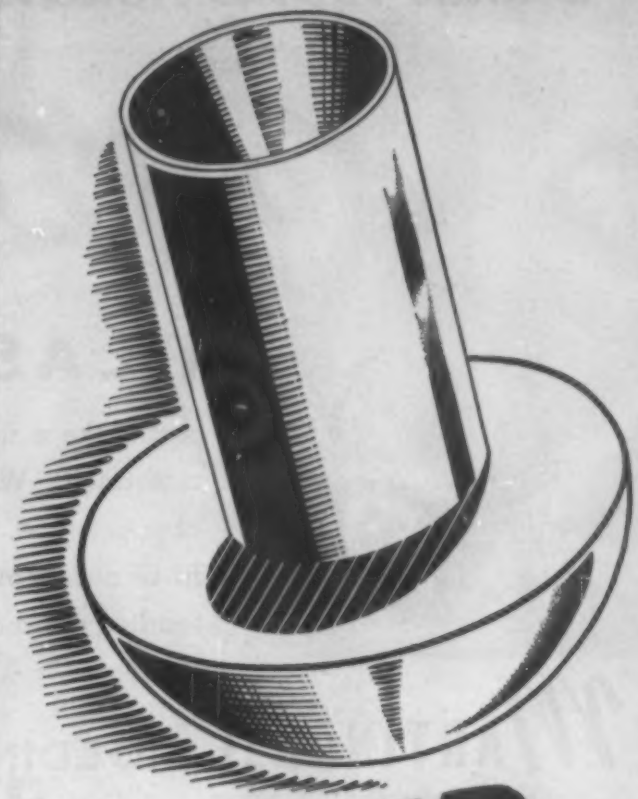

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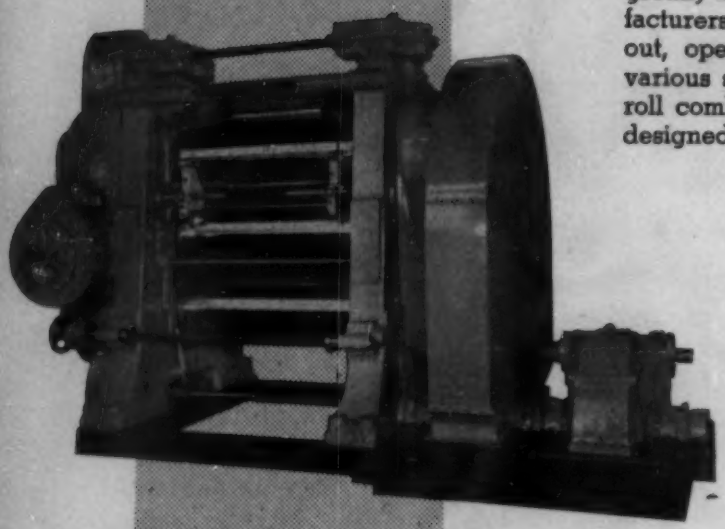

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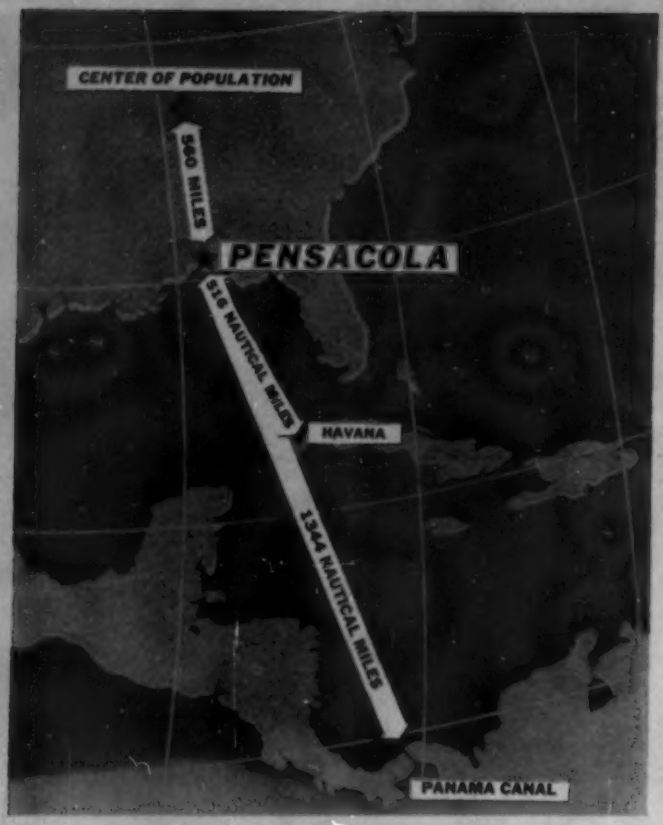

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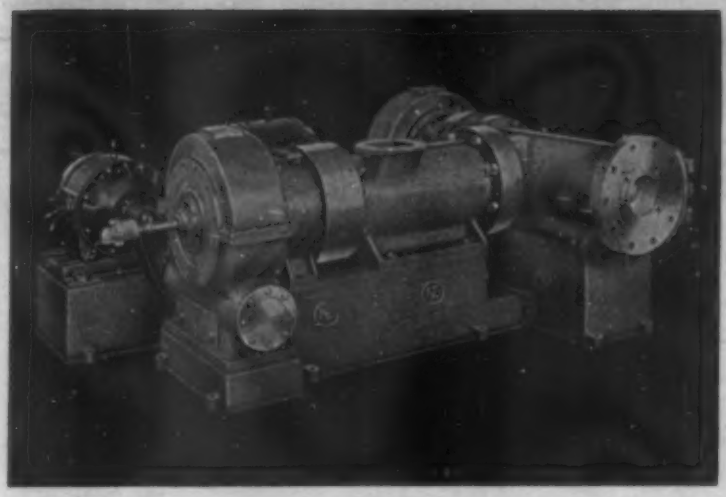

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WANTED: Injection Molding Dies. Will buy or run on royalty basis. Must be good volume retail item. Give full details, sample or description of product, size and condition of die, weight per shot. Write Box 1386, Modern Plastics.

WANTED—4 to 8 oz. vertical injection molding presses, any make but must be excellent condition. Reply to Noma Electric Corp., 55 W. 13 St., N. Y. C.

WANTED: Plastics Engineer—To supervise development of moulds, dies and mechanical trials by injection moulding — In recently established Plastics Department of old established company—Permanent position and good possibilities for growth and advancement—Write, giving age, experience, salary expected, availability. Reply Box 1379, Modern Plastics.

LARGE REPUTABLE CONCERN anticipating entering Plastics field. Will need services of man thoroughly familiar with manufacture of Synthetic Resins (thermosetting type) for compression molding. Location Middle West. Reply Box 1380, Modern Plastics.

SALES ENGINEER—Wants connection preferably with firm doing engineering & design work for other manufacturers. Ten years with large merchandising firm as salesman, buyer, service mgr. and field engineer. Operated own firm as mfg. agent for one year prior to entering service. Reply Box 1381, Modern Plastics.

HOB CUTTER and Model Maker—With exceptional creative ability, who understands cavities and moulds thoroughly, at present employed by a large plastic concern, but wishes to make a change and connect with an organization who can appreciate and employ a man of rare skill. Reply Box 1382, Modern Plastics.

SOUTHERN CALIFORNIA distributor of Plastic materials, equipment and supplies desires to represent manufacturers of the following items: Woodworking power tools, Saw blades, Abrasives, Buffing compounds, Cloth buffing wheels; Plastic materials in sheet, rod, tube or powder form; Moulding equipment, both laboratory and production types. Reply Box 1383, Modern Plastics.

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ENGINEER, Plastics Institute Graduate, desires represent custom molder, New York Metropolitan District. Have offices and showrooms New York and New Jersey. Reply Box 1385, Modern Plastics.

MOLDING POWDERS WANTED. A concern with good distribution possibilities, but no manufacturing facilities, wants a line of Molding Powders to sell under its own brand, assuming all selling, advertising, collection expense, or will make other suitable arrangements. Reply Box 1388, Modern Plastics.

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WOULD LIKE CONTACT with Plastic Mfg. Co. to manufacture on a royalty basis, an article that will really sell. Can be sold thru the dime stores, and will have a fast turnover. Reply Box 1408, Modern Plastics.

INTERESTED in a Farrel 3A Bambury 18-40 or larger, 2 roll rubber mill #2 or larger, rotary cutter, rotex sifter mixes, and magnetic separators. Reply Box 1399, Modern Plastics.

FOR SALE: Hydraulic Presses; 600 ton Watson Stillman double acting downward ram, platen 24" x 24", 2—Automatic and self-contained Hydraulic Crimping and Assembling Units, 2—20" x 20" 10" ram, 75 tons, 1—24" x 24" 6" ram, 75 ton, 3—12" x 12" 7½" dia. ram, 50 ton 2—15" x 15" 8" dia. ram, 75 tons, 1—20" x 40" 2—8" dia. rams, 100 ton, 2—20" x 18" 200 tons with pushbacks, 1—20" x 16" 200 ton with pushbacks, 1—24" x 24" 250 ton, with pushbacks, 1—52" x 26" 14" ram 400 tons, Pumps; 1—National Triplex 3 GPM 4000#, 1—HPM Triplex 1½ GPM 2500#, 1—4 plunger 6 GPM 2250#, 1—West Triplex 7½ GPM 3000#, 1—Watson Stillman 4 plunger box type 2 GPM, 4400#, 1—HPM Triplex 1½ GPM 2000# on high, 16 GPM 400# on low, V Belt Pulley, 1—Hele Shaw JLP 12, 44 GPM 1200# with new control, 2—Vickers 27 GPM 1000#, Accumulators; 1 Watson Stillman hydropneumatic type, 1.86 GPS 3500# pressure with by-pass valve, 1—Buckeye high and low pressure tank type, 3½ GPS 4000# and 20 GPS 500#. Extruders, Mills, Calender, Mixers, Laboratory Presses, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 385 Hudson Street, New York City 13.

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FOR SALE—3 Curtis-Marble Flock Cutters in good condition. Can be used for grinding plastic scrap. Reply Box 1397, Modern Plastics.

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Technical man experienced in transparentizing paper. Ability to work with research chemists and design or assist in the design of equipment for transparentizing papers. Experience more important than age. Give complete information in first letter, including salary requirements. All answers held confidential. Reply Box 1400, Modern Plastics.

WANTED: Laboratory equipment listed below—Analytical Balance with weights; Tensil tester for soft rubber; Tensil tester for hard rubber; Aging oven; Compression machine; Laboratory mill—6" x 12" roll size. Please give full description and state price. Hershberg Products Company, Ashtabula, Ohio.

WANTED—SALES MANAGER who knows where industrial molded plastics should be used and the people who should use them; who can organize sales and engineering effort in cooperation with his customers to provide them with molded parts designed to fit their needs but economical to produce. Modern factory, competent engineering, and sound business management to back him in his efforts. Facilities for compression, transfer and injection molding. An opportunity for the right man to work effectively, live where living is good, and be paid what a good job is worth. Location: Southern New England. Reply Box 1401, Modern Plastics.

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Engineers with experience in production of overlays, laminates, castings, extrusions, etc., from thermosetting plastic. Must be familiar with applications, economics, materials, plant equipment, plant layout, specifications and techniques. Several engineers will comprise a group to cover the above.

Replies should give detailed information regarding education, experience, type of work preferred, salary expected, and include a recent photograph. All information will be confidential. Location, California. Reply Box 1402, Modern Plastics.

BUSINESS MAN, 41, college grad. over 15 years experience in management and sales, has $10 to $15,000 to invest as active partner in progressive plastic manufacturing plant operating at present and needs additional capital for expansion. Reply Box 1393, Modern Plastics.

SCANDINAVIAN Machinery Manufacturer anxious to contact American Machinery Designers of Plastic Injection molding presses to be manufactured for distribution throughout European markets. Reply Box 1406, Modern Plastics.

PLASTICS ENGINEER: Research and Development in methods of testing, molding, casting, laminating, compounding and fabricating. Wide background in synthetic resins, including rigid and elastomeric thermosetting and thermoplastic materials for electrical and mechanical applications. Present employment in research laboratory of foremost communications equipment organization. Excellent references. M.S. Age 29, married. Responsible position with progressive firm desired. Reply Box 1403, Modern Plastics.

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MODERN PLASTICS
Published by MODERN PLASTICS, INC.
122 EAST 42nd ST., NEW YORK 17, N. Y.

When a technical magazine's title and editorial field cease to match, then in all fairness to its readers and advertisers the title should be changed to fit the field.

The scope of "Metals and Alloys" has in recent years been the selection and processing of materials for manufactured products. Obviously the name "Metals and Alloys" is both inaccurate and misleading as a designation for that editorial field. Therefore the magazine will henceforth have a new name—"Materials & Methods"—a name that perfectly fits its field—engineering materials and processing methods.

Unlike the old name, "Materials & Methods" accurately reflects the magazine's long-established editorial coverage of non-metallic materials, along with metals, as an essential part of the materials-selection problem. The new name also clearly indicates the magazine's approximately equal attention to the methods and equipment for processing materials, on one hand, and to the selection and use of materials, on the other.

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Eye Appeal

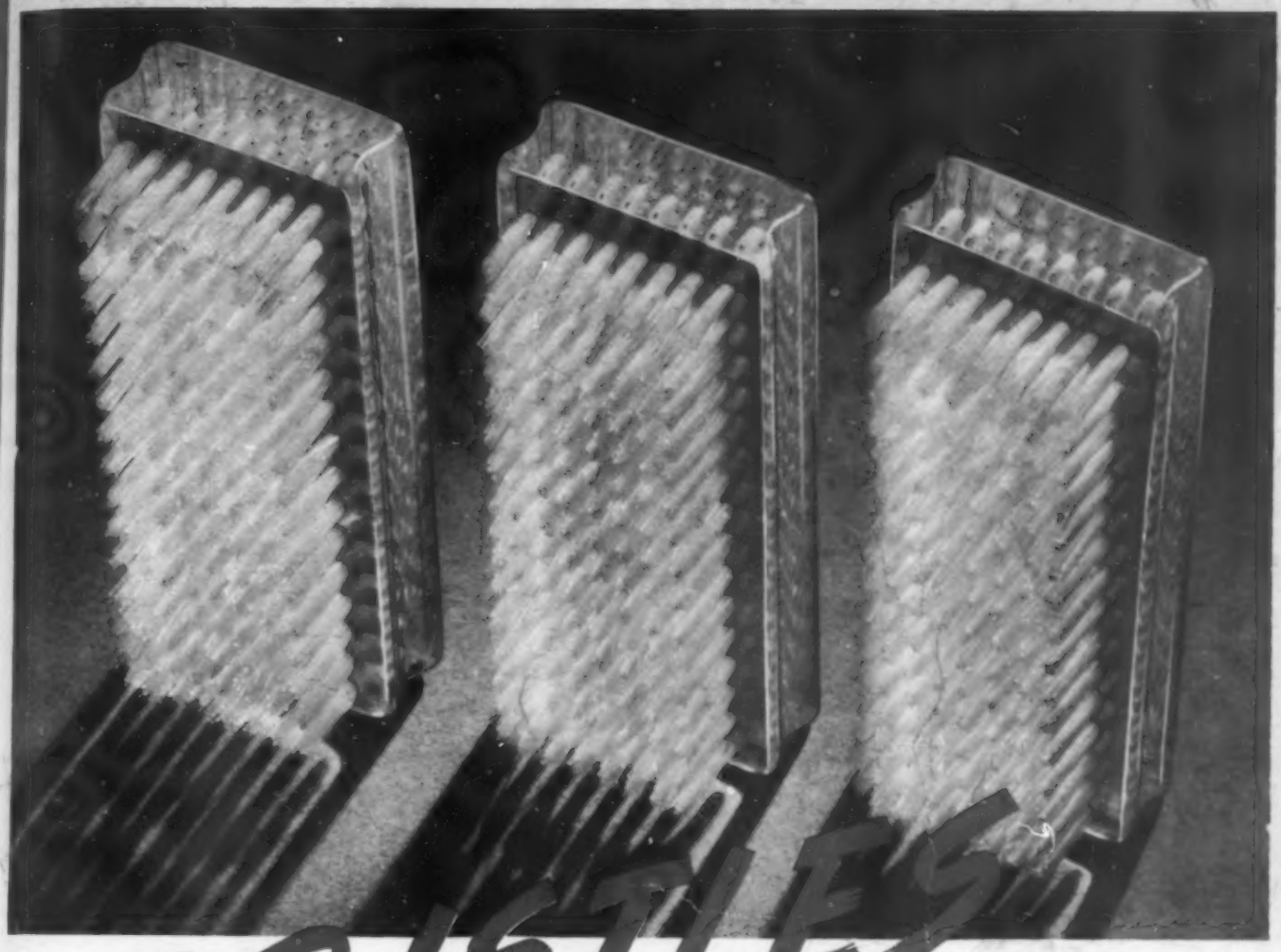
Eye appeal may well rank first when consumer acceptance of your product is at stake. Injection moulded plastics have long proved capable of producing practically every feature to win customer approval — sparkle, artistry, craftsmanship, practicalness and long life — but success in your quest for such standards lies in your first approach. Such questions as which material, which process and even if plastics is suitable to meet your requirements, must be expertly considered from every angle. Only then can you proceed with confidence. These questions are exactly what our trained technicians, expert die designers and die makers and moulders are ready and willing to answer, intelligently and without bias, whenever plastics applications enter your discussions. Our experience in handling hundreds of similar problems — getting the inquirer started right — has always proved of inestimable value. Because we mould for customers only, we give your inquiries whole hearted attention, just as if your problem were one of our own.

Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

14 HYGEIA STREET, WORCESTER 8, MASS.

17 East 42nd St., New York 17, N. Y.
Export Office: 90 Broad St., New York 4, N. Y.



BRISTLES

WITH POSSIBILITIES

HERE THEY ARE! . . . BRISTLES of a brand new kind, with pre-eminent characteristics for a whole range of special purposes. They're VINYLITE plastic monofilaments — supremely stiff, highly resistant to chemicals and abrasion, and much less water absorbent than other synthetic bristles or standard hog bristles.

One well-known brush company is already preparing to feature VINYLITE plastic bristles in its popular lines of nail brushes, men's military brushes, and women's straight tuft hair brushes. In these three fields the new bristles show phenomenal wear; and their surface retention of soapy water produces an outstandingly effective nail brush. Several industrial applications have also been made, and bristles of VINYLITE plastic seem to be the best answer obtainable where acid conditions are encountered.

Write Department 7-E for detailed information about VINYLITE plastic monofilaments. Successfully extruded in a diameter range of 0.008 in. to 0.02 in., they may well bring product improvements and economies not only to brush applications but wherever a continuous filament can be employed in straight or woven form.

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
UCC
30 EAST 42ND ST., NEW YORK 17, N.Y.

VINYLITE
TRADE-MARK
PLASTICS

NEW LONG-RANGE VISION—IN PLASTICS

G-E Complete Service—Everything in Plastics

Backed by 51 years of experience. We've been designing and manufacturing plastics products ever since 1894. G-E Research works continually to develop new materials, new processes, new applications.

No. 1 Plastics Avenue—complete plastics service—engineering, design and mold-making. Our own industrial designers and engineers, working together, create plastics parts that are both scientifically sound and good-looking. Our own toolrooms are manned by skilled craftsmen—average precision mold experience, 12 years.

All types of plastics. Facilities for compression, injection, transfer and cold molding . . . for both high and low pressure laminating . . . for fabricating. And G-E Quality Control—a byword in industry—means as many as 160 inspections and analyses for a single plastic part.

EVERYTHING IN *Plastics*

● Here's something new in optics—and plastics.

The U. S. Naval Observatory binoculars have new universal focus lenses, designed for seeing at night. New, too, is the plastic housing. It makes an instrument that is strong . . . light . . . easy to hold.

To meet exacting optical precision specifications, No. 1 Plastics Avenue combined a new molding process . . . an extremely stable, tough plastic material . . . and a special alloy for metal parts which expand and contract with the plastic. Result: neither tropical fungus nor sinking in a hundred feet of salt water can damage these binoculars.

Perhaps you see possibilities for a similar plastic part in your own product. Bring any plastics problem to General Electric—the world's largest manufacturer of finished plastics parts. Write Plastics Divisions, General Electric Company, 1 Plastics Avenue, Pittsfield, Massachusetts.

GENERAL ELECTRIC